

# 15th International Symposium on Trichoptera



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Rutgers University  
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## Abstracts

Abstracts for **oral presentations**, as submitted by the authors, in the order of their presentations.

Thursday June 4, 9:20-10:20: Ecology session 1.

**1: Ecological characterisation of an unknown fauna using DNA taxonomy - An example with Himalayan Hydropsychidae (Insecta:Trichoptera)**

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In isolated regions like the Hindu Kush-Himalaya, taxonomic difficulties can obstruct studies on spatial and ecological patterns of diversity. We combined molecular tools and ecology in order to investigate the distribution of an unknown fauna of hydropsychid caddisflies along altitudinal gradients and explore potentially influencing factors.

A total of 655 larval specimens from 34 tributaries within four different Nepalese river systems were examined. Phylogenetic analysis of the mitochondrial cytochrome c oxidase I (COI-1 and COI-2) and the nuclear gene 28S RNA were used to delineate independently evolving lineages (“GMYC clusters”) applying the general mixed Yule-coalescent (GMYC) model.

Estimation of species diversity within the family of Hydropsychidae, based on 516 COI-2 mtDNA sequences, resulted in 29 GMYC clusters. High levels of species turnover among river systems indicate high  $\beta$ -diversity, i.e. site-to-site variation across geographical ranges in the Hydropsychidae community, and a great degree of regional endemism. Within each system, community composition was found to vary greatly along the altitudinal gradients, with many GMYC clusters associated with narrow specific altitudinal ranges.

Overall, the results support the utility of DNA taxonomy approaches for biodiversity assessment of poorly studied groups or regions and highlight its further application to explore fundamental questions in freshwater ecology.

**2: Oviposition, rocks!**

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A lack of suitable oviposition habitats produce a bottleneck to successful recolonisation of restored streams by aquatic insects. Adult females returning to a stream may respond to a suite of cues when selecting an oviposition site. Egg mass distribution of different insect species is expected to vary both within and among stream reaches relative to hydrology and land use. What are these cues, and can we quantify them by characterising the occurrence and distributions of egg masses?

We recorded egg mass density and distributions of Hydrobiosidae and Hydropsychidae caddisflies along transects within a 50m reach at six New Zealand streams (three native forest, three agricultural) in spring and summer. Approximately 20 physical stream and channel parameters ranging from overhead riparian cover to substrate size and embeddedness were measured for each intersecting rock.

We tested whether the distribution of these trichopteran egg masses varied between small (reach-level) and large (landuse) spatial scales, and determined what parameters were the best predictors of Hydrobiosidae and Hydropsychidae egg mass presence and density within a stream.

Results indicated the strongest predictors for the presence of Hydrobiosidae egg masses were emergent rocks and their above water surface area, and percent cover of overhanging riparian vegetation. Whereas the surface area of submerged rocks and site were the strongest predictors for the occurrence of Hydropsychidae egg masses.

### **3: Oviposition dynamics and larvae development of *Chaetopteryx villosa* (Trichoptera: Limnephilidae)**

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*Chaetopteryx villosa* is characteristic for small lowland streams and springs. Adults appear at the end of September and are observed even at winter, when temperatures oscillate around zero Celsius degree. Imagines are almost flightless, however, male's weight is half of females, which makes them more mobile. Copulation lasts relatively long time, sometimes longer than 2 weeks. *C. villosa* is univoltine, however long period of emergence (often at unfavorable conditions) and long copulation time influence the time of oviposition (sometimes 2 to 3 months) resulting in desynchronisation in larval development. This facts prompted us to carry out research focused on the frequency of oviposition by one female and the number of laid egg-masses and the number of eggs in the egg-masses. We also tried to assess other factors, such as the length of copulation and correlation between number of partners and number of eggs in egg masses and female's life duration.

The research were carried out at Wolbórka spring located Southeast of Łódź and in the laboratory. Field observation as well as laboratory rearing indicated one, approximately 6 weeks long emergence period (from the end of September until the mid November). The results suggest that adults are capable of a long life, sometimes longer than two months. Prolonged period of imagines appearance correlated with prolonged period of *C. villosa* egg masses occurrence. Fresh and filled with eggs egg-masses were found at Wolbórka spring from the 8<sup>th</sup> of October until even the 26<sup>th</sup> of February. However, quantities of egg-masses in the field were not equally distributed during the observation frame. The research revealed two oviposition peaks: starting from the middle of October until first week of November and from the third week of November until the early December (or even later). First oviposition peak was characterized by average high number of eggs in the egg-masses while during the second oviposition period the average number of eggs was reduced by half. Laboratory rearing exposed that females were able to lay eggs more than once during their life cycle. The number of eggs in every egg-masses were counted using the authors method.

Research indicated not only diverse, temperature-dependent development of larvae but also high mortality of eggs and embryos in the egg-masses. The inequality in larvae development was evident especially in early spring, but with time this disproportion become more blurred. Larvae started to pupate almost at the same period of time, and the cycle was repeated. *C. villosa* life strategy exposed tendency to maximize the reproductive success by having two periods of eggs laying, named by us as main and complementary. Such strategy appears as a result of numerous compromises between optimal emergence time, oviposition, long copulation and mortality developing in the winter eggs and larvae.

### **4: Impacts of Sedimentation from Oil and Gas Development on Caddisfly Populations in Two Adjacent Watersheds of the Allegheny National Forest, Pennsylvania, USA.**

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The Allegheny National Forest (ANF), located in northwestern Pennsylvania, is a multiuse forest combining commercial development with recreational and conservation activities. As such, portions of the ANF have been heavily logged and are now the subject of widespread oil and gas development. This rapid increase in oil and gas development has led to concerns about sediment runoff from the dirt and gravel roads associated with development and the potential impact on the aquatic biota of the receiving streams. We examined and compared the caddisfly, and other benthic macroinvertebrate communities in two adjacent watersheds of similar size and topography in the ANF; the Hedgehog Run watershed has no oil and gas development, while the adjacent Grunder Run watershed has extensive oil and gas development.

In Hedgehog and Grunder Run, we collected monthly kick-net samples from riffles and glides at two sites from April to October 2010, and light trap samples at the same sites from April to October, 2011. At the same intervals during benthic collecting, we measured standard water quality parameters, including conductivity and turbidity. Despite much higher turbidity in Grunder Run, there was little difference in the diversity and abundance of the caddisflies and other benthic macroinvertebrates inhabiting the two streams.

Thursday June 4, 11:00-12:15: Ecology session 2.

**5: Case Reconstruction Behavior and Mortality of *Pycnopsyche guttifer* (Trichoptera: Limnephilidae) at Different Temperatures with and without Aeration**

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Thermal tolerance is typically assessed via the critical thermal maximum, a laboratory test that measures acute physiological responses to temperatures higher than what would be encountered in nature. To test behavioral changes caused by more natural temperatures, we conducted a chronic (72 h) study on the ability of *Pycnopsyche guttifer* larvae to survive and rebuild their cases with and without supplemental aeration in a laboratory environment. Five different treatment temperatures were used: 17, 20, 23, 25, and 29°C. Larvae were removed from their cases and provided with natural substrate for case reconstruction. As a control, some caddisflies were left in their cases. Case reconstruction in the 17°C and 20°C treatments was 75% successful without supplemental aeration and 88% successful with it. Specimens in the 23°C and 25°C treatments exhibited reduced case reconstruction success (<50%), especially without supplemental aeration. Survival at these temperatures was similar to that of the lower temperature treatments. The 29°C treatment exhibited >60% mortality in the control group and >90% mortality when cases were removed. Mortality was similar for aerated and non-aerated trials. No individual was able to reconstruct its case at 29°C. Since temperatures in their natal habitat can approach 23–25°C during the hottest months of the year — the threshold at which behavior appears to be affected — it is possible that the summer aestivation behavior seen in *P. guttifer* may be a response to thermally suboptimal conditions.

**6: Population Dynamics and Seasonal Occurrence of Adult *Amphipsyche meridiana* Ulmer 1902 (Trichoptera: Hydropsychidae) in an Irrigation Pond Outlet**

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Population dynamics and seasonal occurrence of adult *Amphipsyche meridiana* Ulmer 1902 (Trichoptera: Hydropsychidae) in an irrigation pond outlet at Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom Province were determined, with the influence of air temperature, wind speed, precipitation and relative humidity on its population density being evaluated. Samples were collected monthly from January to December 2013 by light trapping. Monthly sampling records for adults collected were 24876, 2605, 29344, 43632, 18684, 16524, 29871, 15183, 10548, 17100, 7695 and 15678, respectively. An increase in the number of adults collected was observed from January to July with peaks of 43,632 (18.83%) in April. A remarkable decrease in the number of insects collected was observed in the months after August. There was an increase in the number of adults with the decrease in precipitation and relative humidity influencing the most.

**Key words:** Adult insects, air temperature, wind speed, precipitation, relative humidity

**7: Monthly Diversity and Abundance of caddisfly from Upstream and Downstream of the Mae Ngat Somboonchol Dam, Chiang Mai Province, Thailand**

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Mae Ngat Somboonchol Dam; Chiang Mai province, northern Thailand, was constructed in order to serve the irrigation purposes and electricity generation. This hydroelectric dam located across the Mae Ngat river where is the tributary of Ping River. The aim of this work was to study the diversity and abundance of caddisflies in a whole year round. Seven sampling sites; 2 upstream and 5 downstream sites were monthly monitored on the adult male caddisflies using light pan trap from June 2013 – May 2014. A total of 3,844 male specimens belonging to 16 families, 94 species were caught. The top three most abundant common species in this river were *Oecetis scutulata*, *Setodes argentiguttatus* and *Chuematopsyche globosa*, respectively. The species compositions of the upstream and downstream sites were differed. Trichoptera 44 species exclusively presented in the upstream sites for example, *Macrostylum fenestratum*, *Setodes endymion*, *Hydropsyche camillus* and *Ecnomus joachin*, whereas 23 species exclusively presented in the downstream sites for example, *Anthaloptera sexpunctata*, *Chuematopsyche banksi*, *Oecetis tripunctata* and *Ecnomus votticius*. There were 50 species of the new recorded and 20 missing species compared to the previous study in 2009. The diversity and abundance were also differed in each month. The highest number of trapped male caddisflies was found in April and May, which was 352 and 292, respectively. The upstream sites contained the higher number and diversity of caddisflies than the downstream sites.

**Keywords:** Diversity, Abundance, Trichoptera, Thailand, Dam

#### **8: Trichoptera community and thermal gradients in alpine streams in Glacier national park, Montana: Implications for climate change impacts on aquatic biodiversity**

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We studied the distribution and abundance of macroinvertebrates along multiple environmental gradients in alpine streams of Glacier National Park, Montana. Strong patterns of thermal and biodiversity gradients were observed, a finding consistent with other studies in alpine systems. For all stream types (glacier, spring, and snow sourced), taxonomic richness of Trichoptera was positively correlated with distance from source and water temperature. We found a suite of endemic and rare alpine species restricted to short sections (~1 km) of cold streams directly below glaciers, permanent snowfields, and springs. Of these taxa, *Rhyacophila ebria* and *Allomyia bifosa* showed the strongest negative correlation with water temperature and distance to source. Other alpine isolated species included *Rhyacophila rickeri*, *R. glaciera*, *R. belona*, and *R. ophrys*. The future loss of the iconic glaciers in Glacier National Park, predicted to be gone by 2030, has great implications for the future distribution and persistence of alpine, coldwater-adapted species. While climate change may increase local diversity through upward elevational shifts in taxa, the loss of climate-sensitive species and decrease in stream habitat heterogeneity as alpine glaciers and snowpacks continue to shrink will likely lead to an overall reduction in regional biodiversity.

#### **9: Habitat preferences and ecological notes of the subfamily Drusinae in Kosovo SHORT TALK**

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Habitat preferences and ecological notes on eight species of the Drusinae subfamily, are given and discussed based on investigation carried out in more than twenty localities all over Kosovo where larval and adult stadiums are included. Larval stages of five species (*Drusus biggutatus*, *Drusus krusniki*, *Drusus schmidi*, *Drusus tenellus* and *Drusus sivecii*) are strict cold water stenotherm rheophils found only in eucrenal, hyporenal and epirhithral zones. *Drusus discolor* is a cold water stenotherm found in epirhithral and metarhithral zones. *Ecclisopteryx keroveci* is a cold water stenotherm found in epirhithral and metarhithral zone. *Drusus botosaneanui* is a rheo to limnophil found in all kind of streams and rivers from hyporenal to hzporhithral zones. *Drusus krusniki* is found in different altitudes, ranging from 500 to 2000

m asl. *Drusus botosaneanui* and *Ecclisopteryx keroveci* are found in a range of altitudes from 400 – 1200 asl. The rest five species are found only in altitudes above 800 asl. All species of the Drusinae family studied during this investigation, with the exception of *Drusus botosaneanui*, are vulnerable to organic load in streams and are thus expected to be impacted in future considering the continuous increased anthropogenic impact in freshwater ecosystems in Kosovo. *Drusus botosaneanui* on the other side is notorious for being found in streams and rivers with a considerable amount of organic load as well.

**Keywords:** Habitat preferences, Drusinae, ecological notes

Thursday June 4, 1:30-2:45: Taxonomy.

**10: A new species of the genus *Lepidostoma* Rambur (Trichoptera: Lepidostomatidae) from the Indian Himalaya**

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A new species of genus *Lepidostoma* Rambur is described and illustrated from Indian Himalaya. This include *Lepidostoma kjeri* sp. nov. from Mandel (Uttarakhand). This species has been also collected from Munsiayri and Hanumanchatti (Uttarakhand), Dirang from Arunachal Pradesh of the Indian Himalaya. The other species of this genus in India were contributed by Mosely 1939, 1941, 1949a, 1949b, 1949c (17 species); 5 species by Martynov 1936; 4 species by Saini & Parey 2011; 4 species by Parey & Saini 2012; McLachlan 1871, 1878; Malicky 1979, 2003, Ulmer 1905, 1906 and Weaver 1989, 2002 (2 species each); Navàs 1932 (1 species). Two other species i.e. *L. brueckmanni* (Malicky & Chantaramongkol) and *L. palmiles* (Ito) originally reported from Thailand & Nepal respectively has also been reported from India. With the addition of this new species the genus *Lepidostoma* is now represented by 42 valid species from India. The type and paratypes of this species have been kept in the laboratory of Pollination Management, Sher e Kashmir University of Agricultural Science and Technology, Srinagar, Jammu and Kashmir (India). The detailed bar coding of this species shall be traced out during the pre symposia workshop at Rutgers University. **Etymology:** This species is named in honor of Karl Kjer for his great contribution to the taxonomy and molecular biology of world Trichoptera.

**11: The genus *Atanatolica* (Trichoptera: Leptoceridae) from the Neotropics**

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*Atanatolica* is a relatively small leptocerid genus from the Neotropics. Currently, it contains 20 species, distributed from Costa Rica, to the south along the Andes and to the east to the mountains of southeastern Brazil, and between 1000 to 3000 m. The biology of the genus is mostly unknown, but they are apparently associated with small and medium sized, mountain streams and the splash zone in waterfalls. The genus is characterized by the presence of oval frontal setal warts; tibial formula 0,2,2; forewing fork I sessile or petiolate; hindwing fork I generally absent; and tergum tenth generally saddle-shaped and bearing to pairs of apical processes. Herein, I review the genus and present nine new species from Ecuador (4 species), Peru (2 species), Venezuela (2 species), and Costa Rica (1 species). These species are easily differentiated among them and with the described species in the genus by the shape and length of the processes of the tenth tergum (especially in caudoventral view), the inferior appendages, and the preanal appendages as well as the presence of various warts on the ninth segment. With these new species, the total number of species in the genus is 29. According to their apparently restricted distributions, many more new species in this initially thought small genus are expected to occur in nature.

## 12: Singleton-based species and rarity

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A considerable proportion of descriptions of insects species, including those of Trichoptera, are based on single specimens. We ask the question of whether this reflects rarity of these species or some other attribute. In order to answer this we examine data on the Trichoptera fauna of Tasmania and New Caledonia. We note a low level of species synonymy among both faunas but that a significant proportion of singleton-based species have been collected subsequent to the original descriptions. The significance of these figures is considered following examination of data on diversity and abundance of Hydroptilidae collected by regular, standardised light trapping over two years at a northern Australian tropical stream. We conclude that quite a large proportion of the Trichoptera species based on singletons are rare, valid species, but for some the appearance of rarity is probably a consequence of timing of collection or some attribute such as behaviour. Lastly we discuss briefly the impact of rarity, apparent or real, on conservation management.

## 13: Systematics of *Cernotina* Ross and *Cyrnellus* Banks (Trichoptera, Polycentropodidae)

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The family Polycentropodidae is found in all biogeographic regions, except for Antarctica, and has more than 600 described species. Two genera are known to reach their highest diversity in the Neotropics: *Cernotina* Ross, 1938 and *Cyrnellus* Banks, 1913. This thesis aims to revise the taxonomy of the genera, as well as understand the species phylogenetic relationships. The phylogeny component will focus on data from morphological characters, with parsimony and Bayesian approaches. Preliminary observations count on 76 species (67 for *Cernotina* and 9 for *Cyrnellus*), in which about 35 are not described (33 for *Cernotina* and 2 for *Cyrnellus*). Morphological characters are being coded.

## 14: Indian Caddisflies: Past, Present and Future Scenario.

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### Abstract:

As stated by renowned Trichopterologist Dr. F. Schmid who contributed a lot the systematics of Indian Trichoptera that the ecological and environmental set of Indian-sub continent is very favourable for Trichoptera diversity. The geographic location accompanied by the varied seasons along with the annually flowing rivers and their tributaries provided an ecological niche for larval forms which inhabit this part of the world.

The Indian Trichoptera has not been dealt fairly by any systematics and this group though largest among primary aquatic orders remained ignored at the hands of Indian naturalist yet some good work has been compiled by some foreign workers who either managed to get the material on loan basis or collected it during various expeditions to India (Schmid). But no Indian sincerely worked on the taxonomy of Trichoptera. M. S. Saini initiated the work on Trichoptera taxonomy from Indian. He and his coworkers streamlined the literature and published first ever catalogue to species of Indian Trichoptera in 2001. Some workers are working on the larval stages of caddisflies but they are relying on foreign workers for identification as they do not have expertise for identification purpose. Recently many new species were added under various genera viz. *Chimarra* Stephens by Pandher and coworkers (2011, 2sp., 2012, 10sp., 2013, 3sp., 2014, 7sp.), 3 species to *Dolophilodes* Ulmer by Saini & Pandher (2011) and Pandher and Saini (2011) reported genus *Kisaura* Ross for the first time and added 17 new species (Pandher & Saini 2011,

6sp., Pandher *et al.*, 2012, 4sp., Saini *et al.*, 2012, 3sp., Pandher & Saini 2014, 4 sp.), *Pseudostenophylax* and *Apsilochorema* (2sp. each), *Geora* (1sp.) and more than 100 are on the table.

With the changing environment, global warming and human disturbance these niche are being destroyed and get degraded slowly. The larvae of caddisflies are bio- indicators and are important component of aquatic ecosystem. There are many species of caddisflies which are exploited for testing the water pollution in particular stream, lake or river. But this aspect remains unexploited in this part of world. Though some work has been initiated in this area by Dr. Parey but still lot has to be done. So, it is high time to work on this aspect of Trichoptera systematics to save water from pollution if we want to conserve the species richness in this part of World.

Some work has been also done on the Phylogeny of Rhyacophilidae but its just the preparatory and more thorough and specific molecular phylogeny based on DNA bar coding is required to get the complete knowledge of origin, past and present dispersal as well as distribution of the various taxa belonging to this region and will through light on the evolution of caddisflies.

Thursday June 4, 3:30-5:00: Phylogeny.

## 15: A short synopsis

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The Eurasian caddisfly subfamily Drusinae comprises roughly 100 species that inhabit mountain ranges in Europe, Asia Minor and the Caucasus. The Drusinae exhibit high rates of endemism and distribution patterns that indicate a complex evolutionary history, e.g., small scale speciation in allopatric refugia during multiple glacial cycles. Within Drusinae, three different larval feeding groups have evolved, and were identified in a 3-gene phylogeny of the group: i) scraping grazers, characterized by spoon-shaped mandibles; ii) omnivorous shredders, characterized by mandibles with terminal teeth; iii) filtering carnivores, characterized by mandibles with terminal teeth and specialized filtering setae on legs and the first abdominal sternite.

Ultimately aiming to resolve the phylogeny of Drusinae and revise the group, we generated 3805 bp of genetic sequence data from 6 molecular markers (2 regions of mtCOI, mtLSU, 28S, nuCAD, nuWG) to infer species-level relationships within Drusinae. Further, we assessed morphological characteristics of larvae and adults, and identified synapomorphies of the feeding groups. Also, we described several new species using classical taxonomic methods and a phylogenetic approach to delineate species.

Here we present a synopsis of contributions resulting from our scientific activities, and discuss the most recent findings on Drusinae phylogeny and distribution. Within filtering carnivorous Drusinae, which develop unique larval head capsule structures, we identify 3 new species, and discuss patterns of evolution, as species with weakly modified head capsules are recovered as basal in Bayesian analysis. However, relationships among species with larvae exhibiting more complex setation and structure are not fully resolved in the analysis, impeding interpretation of results. New species in the grazer clade are described, highlighting the importance of the Western Balkans as centres of speciation and species richness. Further we discuss potential threats to aquatic biodiversity in Europe and the Western Balkans in particular.

## 16: Molecular Phylogeographic Analyses of *Anisocentropus* Caddisflies (Calamoceratidae)

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The habitats of aquatic insects are generally categorized into running water environments (*i.e.*, lotic environment) and standing water environments (*i.e.*, lentic environment). There is a large difference between these environments, in terms of the stability, sustainability and continuity of their respective habitats. Therefore, it is considered that the typical genetic structure of organisms adapted to each of these respective habitat types is significantly different (Arrbas et al., 2012). However, two conflicting hypotheses have been proposed: (1) that organisms adapted to lentic environments have higher dispersal ability, and as a result the scale of their gene flow is greater (Arrbas et al., 2012), and (2) that organisms adapted to lentic environments have an increased level of genetic differentiation (Hughes et al., 2013). This is hypothesized as being because lentic environments are usually scattered and isolated, with patchy distributions.

When considering these hypotheses, *Anisocentropus* caddisflies are very interesting groups, as these caddisflies consist of species adapted to both the lotic and lentic environment types. As such, it is a very valuable case having the presence of both types of specimens among such closely related species. *A. kawamurai* mainly inhabits pools of the mountain streams containing fallen leaves. On the other hand, *A. pallidus* mainly inhabits pools containing fallen leaves at the edge of ponds or lakes. In a previous study (Ito, 2012), it was suggested that habitat based niche differentiation occurs between the two species. As such, we set about conducting a study in order to consider a comparison of the genetic structures found among these species within East Asia. By way of comparison in the Japanese Archipelago, the degree of genetic differentiation observed among populations of *A. pallidus* (adapted to lentic environments) was slightly larger than that of *A. kawamurai*. However, within the species *A. kawamurai*, an extremely high degree of genetic diversity was observed among the populations of the Korean Peninsula. In addition, our results revealed a large degree of genetic differentiation for *A. kawamurai* between the populations of Japanese Archipelago and the Korean Peninsula. With respect to *A. kawamurai*, populations located between on the Tsushima Islands, they were shown to be genetically closer to the populations of the Japanese Archipelago.

**Key words:** DNA, East Asia, phylogeny, biogeography, geohistory, habitat preference

## 17: Discovery and population genetic patterns of *Rhyacophila lobifera* in an urbanized southeast Michigan watershed

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The earliest known southeast Michigan record of *Rhyacophila lobifera* is from the lower Rouge River in 2003, with a second specimen collected from that same site in 2008. Since then, the known range of this species in the Rouge River watershed has expanded to include one additional site on the Lower Branch and five sites on the Middle Branch (Johnson Creek), as well two sites in the neighboring Huron River watershed. Morphological identification has been confirmed with DNA barcoding of the COI gene. Moreover, sequence analysis has suggested fine scale population structure in the Rouge River watershed, with haplotype partitioning between sites on the lower and middle branches. While the only prior Michigan record of *R. lobifera* came from the Au Sable River in 1938, this species has been documented in the nearby states of Ohio, Indiana, and Illinois, and province of Ontario. Additionally, *R. lobifera* ranks 4 on the Hilsenhoff's biotic index. As such, its discovery in an urbanized southeast Michigan watershed is not completely unexpected, but population patterns may lend insight into recent expansion.

## **18: The postlarval development of the mandibular musculature in Trichoptera revealed by $\mu$ CT data**

Martin Kubiak<sup>1</sup>, Anika Pinkernell, Lena Loosmann, and Frank Friedrich

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The caddisfly pupa is equipped with functional mandibles and free body appendages (decticous pupal type). It was assumed that the muscles associated with the mandible are exclusively used by the pharate adult to open the cocoon and become atrophied after hatching. This hypothesis was never proven experimentally as the exact age of specimens caught in the wild is usually unknown. In some lineages (e.g., Annulipalpia) adults possess well-sclerotized mandibles whereas these mouthparts are reduced in others (e.g., Integripalpia). The associated adult mandibular musculature is also reported as strongly reduced for the latter. In order to explain the differences described for the mandibular muscles of caddisflies, an integripalpian and an annulipalpian species were reared. The adults were fixed at exactly defined points (0–50 days) after eclosion. Micro-computer tomography was applied for one individual per age class and species. Based on the 3D-data the volumes of the mandibular muscles were measured. A remarkable atrophy of the mandibular musculature has been observed in both species within a few days after eclosion. It could be demonstrated that the opposing morphological descriptions are very likely caused by the use of specimens of different age collected in the wild. Consequently, the supposed phylogenetic relevance of the presence or absence of mandibular muscles in adult trichopterans can be refuted.

Friday June 5, 9:00-2:30: Plenary Session.

## **19: History of Neotropical Trichopterists**

Oliver S. Flint, Jr.

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Flint discusses early taxonomists who described Neotropical Trichoptera, starting with Perty, through some of the great names like Bermeister, Hagen, McLachlan, and more recent workers, such as Ross and Schmid.

## **20: Current status and recent advances in Trichoptera diversity and systematics: a review of the literature from 2000**

Ralph W. Holzenthal

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The initial years of the current millennium have seen a surge of new information and knowledge about Trichoptera. The order currently contains more than 15,000 species, ca. 5000 more than was known 15–20 years ago. Much of this new diversity has been described from focused research efforts in tropical regions in South America, southeast Asia, and the Pacific. Studies involving DNA sequence data have flourished during this period, advanced our understanding of the evolution of the order. The first molecular phylogeny of the order appeared, followed by others, such that there is a growing consensus on the origin of the order and the evolution of its remarkable case and retreat making behaviors. Molecular studies appeared addressing historical processes responsible for the geographic distribution of caddisfly species based on gene sequence data. DNA barcoding has aided the discovery of new, cryptic species and genetic diversity and well as the association of life history stages. Molecular data have also informed conservation priorities, especially in light of global climate change. At the same time the value of taxonomy and museum specimens is seen as being more important than ever in assessing species diversity, not only for questions in evolution and biology, but also for measuring the effects of a warming Earth. Morphological studies have also addressed novel suites of characters broadly across the order from both a functional and phylogenetic perspective. The Internet has allowed information in the form of species lists, literature, gene sequence data, and images to become broadly available and it has facilitated communication among workers and across disciplines.

## 21: Integrative Trichoptera phylogenetics in today's "big data" environment

Karl Kjer

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"Big data"; the collection of genomes or transcriptomes with high-throughput sequencing, has revolutionized today's phylogenetics. One might also consider international efforts to sequence a single (barcode) locus from every species on earth another kind of big data. Kjer addresses the philosophical and analytical challenges of big data, and describes some of the solutions used in the 1KITE project to produce a well supported insect phylogeny from transcriptomes. There are many other sources of data as well, from genomes to single-locus "barcode" data. Some of these data sources such as barcodes combined with targeted PCR, are well suited to undergraduate teaching, or alpha taxonomy. Others, such as exome capture using degraded DNA from museum specimens, fill gaps in taxon sampling where transcriptomes are impossible to collect. Little attention has been directed toward coordinating diverse datasets into a unified picture of insect evolution, from the root to the tips of the tree. Kjer proposes a strategy to do that, using Trichoptera as an example. The strengths and weaknesses of each technology are discussed.

## 22: Molecular phylogenetics offers insight on the ecological diversification of caddisflies

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*Wolfram Graf (University of Natural Resources and Life Sciences, Vienna, Austria)*

*Karl Kjer (Rutgers University, New Brunswick, New Jersey, USA)*

*Paul B. Frandsen (Smithsonian Institutions, Washington, D.C., USA)*

*Alan R. Lemmon (Florida State University, Tallahassee, Florida, USA)*

*Ildiko Szivak (Balaton Limnological Institute, MTA Centre for Ecological Research, Klebelsberg, Hungary)*

*Simon Vitecek (University of Vienna, Vienna, Austria)*

*Johann Waringer (University of Vienna, Vienna, Austria)*

Trichoptera are the richest purely aquatic insect order and have diversified ecologically to inhabit all types of aquatic habitats across most of the Earth. We present some examples that show how phylogenetic studies of selected taxa can provide insights into this diversification.

We investigate the role of climatic and geological factors that likely contributed to the diversification of the genus *Chaetopteryx* in the Western Balkans using a multi-locus, dated phylogeny of the group, as well as reconstructions of climatic and geological niches. While main splits in the genus coincided with past geological and climatic events, we observed the repeated occurrence of sister lineages in two climatically distinct environments. Our results suggest that climate change may directly influence the formation of biodiversity, beyond driving range shift-related allopatric speciation.

The genus *Drusus* comprises ~100 species and exhibits different feeding types, including a unique predaceous drift-filtering foraging behavior. A six gene phylogeny clearly shows larval feeding groups to be monophyletic, and that the derived feeding type (grazing) and the unique feeding type (filtering) were likely promotor of increased diversification.

With over 700 species *Rhyacophila* represents one of the most species-rich genera in Trichoptera. Some larvae of *Rhyacophila* possess abdominal and/or thoracic gills of varying complexity. Stream zonation preferences, respiration and osmoregulation have been hypothesized to correspond with gill shape. Using an anchored hybrid enrichment approach (AHE) we sequenced and analyzed ~520 nuclear loci from protein coding genes for a total of ~130k bp from 20 species of the *R. vulgaris*-group and 30 other *Rhyacophila* species. Our results show that within the *R. vulgaris*-group complex gill shapes are derived, and progressively evolved into increasingly complex shapes, while absence of abdominal gills represents the ancestral state. We discuss potential ecological implications of gill shape evolution in the *R. vulgaris*-group.

### **23: Molecular Phylogeography of *Palaeagapetus* caddisflies (Hydroptilidae, Ptilocolepinae)**

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The hydroptillid caddisfly, genus *Palaeagapetus* consists of nine species distributed in parts of the Holarctic Region. Their larvae feed on particular liverworts, and are highly specialized for cold flowing, freshwater springs and small mountain streams. We conducted molecular phylogeographic analyses of all nine *Palaeagapetus* caddisflies (i.e., *Palaeagapetus flexus*, *P. ovatus*, *P. fukuiensis*, *P. parvus*, *P. shikokuensis*, *P. kyushuensis*, *P. finisorientis*, *P. nearticus* and *P. celsus*), based upon the partially genetic sequences of their mitochondrial DNA (COI, 16S rRNA) and their nuclear DNA (histone H3, CAD). Phylogenetic analyses showed two major lineages among the nine species, in the analyses results of any of the targeted genetic regions. The geographic boundary between the two lineages was identified as being in the central part of Japan's main island, Honshu. From these results, we concluded that the ancestors of the two distinct lineages migrated to Japan via two different land bridges. We also found that *P. ovatus* was a paraphyletic taxon. In particular, we detected a large degree of genetic differentiation between the Hokkaido, Tohoku and other populations.

**Key words:** Trichoptera, phylogeography, mitochondria DNA, nuclear DNA

### **24: The larval head anatomy of *Rhyacophila fasciata* HAGEN 1859 and its implications on mouthpart homology and the phylogeny of Trichoptera**

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The knowledge on the cephalic anatomy of trichopteran larvae is largely restricted to external skeletal features (e.g., pigmentation, setation). Detailed information on internal structures (endoskeleton, musculature, nervous system, digestive tract) is only available for very few species, mainly representatives of Integripalpia. It was never questioned that the spicipalpian families play a crucial role in the reconstruction of the trichopteran phylogeny. Thus the almost complete lack of data on the larval head anatomy in these groups is obviously a serious problem. A long-debated problem is the homology of the larval mouthpart sclerites and appendages, which are variably shaped in different lineages. The derivation of the maxillary and labial sclerites can only be assessed with a detailed knowledge of the associated muscles.

The cephalic anatomy of the larva of *Rhyacophila fasciata* HAGEN 1859 (Rhyacophilidae) was studied using a combination of traditional (SEM, histology) and modern techniques (CLSM,  $\mu$ -CT, 3D-reconstruction). The main part of our presentation will be the first detailed documentation of spicipalpian larval head structures. We will also present reconstructed ground plan features belonging to this complex character system. The derivation and homology of the mouthpart sclerites will be discussed combining our own results with literature-based data.

### **25: The New Caledonian Trichoptera diversity – present status of knowledge**

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New Caledonia is a country comprising a group of islands situated in the Pacific Ocean, approximately 1,200 kms east of Australia. The largest islands are the three Loyalty islands, Ile de Pines, and Grande Terre, the two latter considered being fragments of the former Gondwana super continent, and which together with New Zealand separated from Australia approximately 66 million years ago. According to

recent hypotheses New Caledonia was submerged till 37 million years before present. The island was at the time of emergence more or less completely covered by marine ultrabasic substrate, which gradually eroded to present day level, concealing about one-third of the total area. The first Trichoptera species recorded from New Caledonia were four species described by Kimmins in 1953 into four new New Caledonian endemic genera. The diversity increased to eight species by the publication by Sykora in 1967 who described three new species in two new genera and a fourth species in a previously established genus. Today, 239 valid species are known from the country, representing 20 genera in 10 families. After analysing the published records, including 32,000 Trichoptera individuals collected from 291 sites or localities, we see that the highest species diversity is in the SE part of the Grande Terre, and the highest species diversity is in the lower altitudes, i.e. 0-200 meters above sea level. We also see that the three most frequently collected families (85 % of the individuals) in the sampled material are the Hydroptilidae (35%), followed by the Hydropsychidae (27 %), Leptoceridae (22 %). Ultrabasic substrate is poor in nutrients and rich in certain toxic heavy metals, and phylogenetic analyses have demonstrated that the first species to occupy the island, and the first subsequent radiations took place on areas covered by ultrabasic substrate.

## **26: Evidence for cryptic species of the Brazilian *Barypenthus* Burmeister (Odontoceridae)**

Daniela M. Takiya<sup>1</sup>, Clayton Portela, Allan P. M. Santos, Ana Lucia Henriques-Oliveira, Fernanda Avelino-Capistrano, Jorge L. Nessimian

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*Barypenthus concolor* Burmeister, 1839 is considered the sole valid species in its genus. Most geographical records of this species are from Southeastern and Southern Brazil states Espírito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ), São Paulo (SP), and Paraná (PR), however, recently this species was recorded from Bahia (BA, Northeastern Brazil), based on one male specimen. Larvae are found in pool areas of clean first to third order streams, usually above 600 masl, and adults are active during the day between the months of January through April. In a review of the genus, Paprocki (2002) considered all six other described species names in *Barypenthus* as synonyms of *B. concolor*, even though some slight morphological variation in the shape of the male preanal appendages and the female vaginal apparatus was observed in available specimens. In order to investigate the genetic diversity found in *B. concolor* populations and try to relate genetic units to morphological variants, we have so far, sequenced 657bp of the mitochondrial cytochrome oxidase I of 68 specimens of *B. concolor*. These specimens were collected in the following mountain ranges in Brazil: Serra do Mar (Serra da Bocaina, SP; Nova Friburgo, RJ; Serra dos Órgãos, RJ); Serra da Mantiqueira (Itatiaia, RJ; Caparaó, ES); Serra do Espinhaço (Itabirito, Serra do Caraça, Serra do Cipó, MG); Serra da Jibóia (BA); Serra da Canastra (MG); and Pirenópolis (GO). Based on a preliminary Neighbor-Joining analysis of K2P pairwise distances, five monophyletic lineages with high bootstrap support were recovered, each with a maximum of 6.6% intralineage divergence. Pairwise distances between these five lineages ranged from 7.9-18.8% (mean=15.2%), distances comparable to interspecific divergences amongst other Odontoceridae, such as *Marilia* Müller and *Psilotreta* Banks. Additionally, a congruent separation of two of these lineages is also corroborated with the analysis of a smaller sampling of 21 sequences of nuclear carbamoyl-phosphate synthetase II (CAD, 837bp). A morphological study conducted on male representatives of three of these lineages, found characters to diagnose at least three of these species, including in the relative length of the inferior appendages relative to preanal ones, however, very few specimens were studied so far. Thus, these five lineages are herein treated as cryptic species. Two of these cryptic species are restricted to Serra dos Órgãos, one to Serra da Jibóia, and another one to Serra da Canastra and Pirenópolis. All remaining specimens belong to the more widespread species, including those from type-localities of *B. concolor* and four of its six synonyms (other two synonyms without precise type-locality). A median-joining network of haplotypes of the latter lineage of *B. concolor* suggest high haplotype diversity and higher gene flow between populations of Nova Friburgo, Itatiaia, and Serra da Bocaina, of the populations studied. Further completion of CAD sequencing and the inclusion of additional specimens from the less sampled localities will be conducted in the future.

## **27: Updates to the Trichoptera Literature Database and an introduction to the Trichoptera Library Project**

Patina K. Mendez<sup>1</sup>, Ralph W. Holzenthal<sup>2</sup>, Josh W. H. Steiner<sup>3</sup>

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The Trichoptera Literature Database (<http://www.trichopterlit.umn.edu>), first launched in 2009, contains 12,800 curated citations for scientific literature published on Trichoptera. The database is searchable online and links to approximately 800 full-text PDFs. This year we expand the Trichoptera Literature Database with the Trichoptera Library project to host a wider range of PDFs not limited to those in the public domain. In a collaboration with the Internet Archive (<http://www.archive.org>), we host PDFs through the Open Library (<http://openlibrary.org>). Open Library allows individual articles to be digitally borrowed in PDF or ePUB format similar to checking out a library book. Hardcopy versions of the original articles are cataloged and stored at the Internet Archive warehouse and we may lend as many digital versions as we have hardcopies. This extension of the Trichoptera Literature Database requires that the Trichoptera Library owns hardcopy original reprints; we seek donations of surplus reprint literature from authors in the Trichoptera community so that we may scan and lend them digitally.

Friday June 5, 1:30-2:45: Faunistics.

## **28: Evaluation of the conservation requirements of Trichoptera from the Tsitsikamma mountain streams in South Africa**

Ferdinand C de Moor<sup>1,2</sup> and Terence A Bellingan<sup>2</sup>

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<sup>2</sup> Department of Zoology and Entomology, Rhodes University, Grahamstown 6139, South Africa.

During 2008–2009 we conducted a four-season survey of Trichoptera from 20 sites in 11 rivers flowing off the Tsitsikamma mountains in the Eastern and Western Cape. The study produced 42,683 adults and 6741 larvae, comprised of 48 species in 12 families. Of these species, 33 are regional Cape Floristic Realm (CFR) endemics with Trichoptera also being the numerically dominant freshwater macroinvertebrate taxon. Some specimens of Trichoptera that could not be recognised as described species, are now the subject of further studies. We also noted distinct differences between rivers, in terms of species composition of Trichoptera. This can be partially explained by the physicochemical and ecological attributes of the rivers surveyed. Anthropogenic disturbances were noted in most of the lower reaches of the rivers. The upper reaches of the rivers could be statistically grouped together and thus be considered as a unit for conservation. The highest diversity, of 25 species, was recorded from the pristine upper reaches of the Bobbejaans River. An evaluation of conservation requirements identified a number of threats: increased loads of fine sediment and nutrients, higher water temperature regimes, and changes to pH, from the natural acid condition (pH < 5.5) to neutral or alkaline conditions. Any of these changes would be detrimental to the survival of many of the endemic Trichoptera in the CFR, and all of these changes would be exacerbated by decreased water-flow volumes. It is thus important to limit the levels of water abstraction from these rivers: to ensure the maintenance of cool temperature and acidic pH regimes while limiting nutrient levels in the rivers. Conservation of the lower reaches of the rivers is also recommended, to maintain an ecologically-functional continuity with upstream reaches, and to enable the occupation of all zones of the rivers with a diversity of CFR freshwater endemic species. We have also selected certain CFR Trichoptera as indicators of favourable conditions for the maintenance of viable populations of CFR-endemic freshwater species.

## 29: Biodiversity of Trichoptera from Islands in the Thai Gulf and the Andaman Sea, Thailand

Pongsak Laudee

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A biodiversity of Trichoptera fauna was studies from seven waterfalls in six islands from Thai Gulf and Andaman Sea, Thailand. Sixty five species, twenty six genus and twelve families of caddisflies were found. The dominant families of the caddisfly in the islands were Hydropsychidae, Philipotamidae, and Leptoceridae. *Cheumatopsyche chrysosthemis* Malicky and Chantaramongkol, 1997 and *Chimarra khamuorum* Chantaramongkol and Malicky, 1989 were the abundant species found from the Islands. Occurrence of Trichoptera species in the islands and neighboring areas is discussed by comparisons with prior work.

## 30: Trichoptera of Ecuador

Blanca Ríos-Touma<sup>1</sup>, Ralph Holzenthal and Jolanda Huisman

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Approximately 290 species in 16 families are known from Ecuador. In the recent years, several expeditions have increased the species reported for Ecuador. Approximately 70 new records of species have added and probably 50 new species have been found. In general, the pacific slope seems to be more diverse, with up to 50 species compared to the Amazon slopes with around 40 species. Altitude seems to play an important role, where medium elevations (around 1000 m asl) are more diverse. These preliminary expeditions showed the amazing diversity of caddisflies in Ecuador. The fact that several new species were reported at each locality exhibits that a lot of this diversity remains to be studied. This is particularly urgent, in face of the increasing stream and river degradation due to poor land practices, lack of water sanitation and infrastructure projects.

## 31: Addenda to fauna of caddis flies (Trichoptera, Insecta) in Kazakhstan

Dina Smirnova<sup>1</sup>, Olga Sklyarova<sup>1</sup>, Julia Epova<sup>1</sup>, Lyudmila Kushnikova<sup>2</sup>, Anna Evseeva<sup>2</sup>, Serik Timirhanov<sup>3</sup>

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As of 2012, Kazakhstan water bodies were inhabited by caddisflies of 149 species of 59 genera and 17 families. Studies completed in 2012-2014 complemented the list of caddis flies and updated distribution of the species described earlier.

*Agapetus fuscipes* J Curtis, 1834 (Altyn-Emel passage, Zhongar Alatau) and *Rhyacophila obliteratea* R McLachlan, 1863 (Krasnoyarka river (upper basin of Irtysh River)) have been described for the first time in Kazakhstan.

Data on composition and distribution of caddis flies in Kazakhstan part of Ishim River and its tributaries have been updated. Ten new species of caddis flies have been discovered. Therefore, list of caddis flies species in Ishim River and its tributaries encompasses 14 species. Composition of fauna in upper reaches of Irtysh River and its tributaries have been also updated: previously, 58 species were described for this region and currently 64 species are registered. List of caddis fly species known in the lakes of Tengiz-Kurgaldzhin system (Northern Kazakhstan), which previously had 1 species, have been extended to include another six species. List of caddis flies from the Dzhungar Alatau have been extended with five species, which now encompasses ten species including previously known ones.

It is obvious that caddis fly fauna in Kazakhstan is studied poorly and its further studies are required.

## 32: Pre-European Settlement Distributions of Trichoptera Across Previously Glaciated Regions

Jason L. Robinson, Ph.D.

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Using verified published and unpublished museum, literature and collection records, we have modeled the pre-European settlement geographic range of 215 species of Trichoptera across the Midwestern United States (Indiana, Illinois, Iowa, Michigan, Minnesota, Ohio and Wisconsin). Using we multivariate clustering, we selected explanatory variables from a large suite of landscape scale measures and/or estimates of temperature, precipitation, historic landcover types, soils, geological history, watershed dimensions and properties and similar features. We describe patterns of geographic diversity across the region and discuss implications from these patterns to our understanding of the processes enabling and constraining the colonization of newly created aquatic habitats in the wake of retreating glacial landcover. These modeling results are part of a larger study looking at all three EPT aquatic insect orders (including Ephemeroptera and Plecoptera) across the region, and relating these geographic predictions to expected patterns of change under climate change scenarios. Future directions necessary for this work require cooperation, collaboration and modeling across continental scales to ensure model comparability across species and to analyze phylogenetic signals.

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Abstracts for **Poster presentations**, as submitted by the authors.

### Ecology

#### **1: Respiratory device or not? -comparison of respiratory characteristics between with and without case of caddisfly larvae**

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**1.** By using silk to fashion a variety of shelters and other devices, larval Trichoptera have evolved adaptive systems to exploit a wide range of resources. For some Trichoptera case of larvae has been seeming to act as an aid to respiration and therefore may has enabled them to spread into lentic habitats. On the other hand, even if among phylogenetically related species there are some varieties of microhabitat within a habitat type, or of morphological traits on larval case. We therefore expected that the respiratory advantage based on the case should vary among related species.

**2.** Two congeneric species, *Lepidostoma crassicornis* and *Lepidostoma* sp. are widely distributed in Japan, and often coexist at headwater of stream with rich leaf litters. *L. crassicornis* is abundant in relatively smaller stream than where *Lepidostoma* sp. is. Both of them construct square shaped case using leaf pieces, to which *L. crassicornis* add lateral and dorsal flanges, while *Lepidostoma* sp. do not. To verify efficient respiration based on case, we measured the rates of oxygen uptake by the larvae within and without the case at various dissolved oxygen concentrations in the cylindrical glass-vials filled with water. We also recorded the motions of respiratory undulation of larval abdomen in an artificial transparent tube instead of a natural case.

**3.** From those measurements we obtained the nonlinear regression equation (Michaelis-Menten equation) of the metabolic rates per unit mass of larval body (r) on ambient oxygen concentrations (c). The equations for each species are showed below with and without case, respectively.

*L. crassicornis* : With case :  $r = 7.4 c / (35+c)$ , Without case :  $r = 32 c / (880+c)$

*Lepidostoma* sp.: With case :  $r = 25 \text{ c} / (368+\text{c})$ , Without case :  $r = 10 \text{ c} / (52+\text{c})$

In every equation each unit of  $r$  is  $\text{nmol mg}^{-1} \text{ h}^{-1}$  and each unit of  $c$  is micro-mol/L. The respiratory characteristics with and without case between the two species were contrast sharply. The physiological trait of *L. crassicornis* seemed to be adaptive for low oxygen environment and the case do not seemed to enhance to respire with larva. Also, the characteristics of undulating rates between the two species showed apparently distinct tendencies, regulator and conformer. Our results suggest that the type of the physiological characteristics of insects such as respiration may result in behaviour of microhabitat selection or case construction, even if related species which are coexistence.

Keywords: larval case, congeneric species, *Lepidostoma*, metabolic rates, respiratory undulation

## 2: The climate sensitive zone along an altitudinal gradient in central Himalayan rivers: a useful concept to monitor climate change impacts in mountain regions

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Highland freshwater ecosystems respond rapidly to changing climatic conditions making the biota of mountain streams and rivers particularly vulnerable to climate change. Lack of data and concepts to monitor and manage the potential effects of climate change on freshwater biota is particularly evident in developing countries. Many of the highest and longest mountain systems are found in these regions and provide fundamental water-based services to these countries. The climate sensitive zone (CSZ) concept is based upon changes in community composition along altitudinal gradients that serve as a proxy for climatic gradients. The CSZ characterizes a community of climatically sensitive biota that is likely to react quickly to climate change. We present a framework on how the CSZ can be adapted to and implemented in streams, and demonstrate its applicability for central Himalayan streams of Nepal. We sampled and analyzed benthic invertebrate communities of 58 central Himalayan streams along altitudinal gradients from 1500-4500 m asl. A generalized linear model identified altitude as the only significant, albeit indirect, variable explaining benthic invertebrate composition. We applied species turnover scores and threshold indicator taxon analysis (TITAN) to identify the CSZ in central Himalayan streams along the extensive altitudinal gradients. An altitudinal band between 2900 m and 3500 m was identified as CSZ, and was characterized by 33 indicator taxa. Identifying CSZs in streams can help prioritize resources for monitoring climate change impacts in running waters and help pinpoint stream reaches suitable for testing the efficacy of climate change directed mitigation practices.

## 3: Adaptation of larval *Micropterna lateralis* (Insecta: Trichoptera) to stream drying: 1. Gene expression profiling

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Aquatic ecosystems can be either permanently wet or dry up periodically. Insect species inhabiting temporally dry streams have evolved behavioural, natural history and morphological traits to ensure

survival under drought. The limnephilid caddisfly *Micropterna lateralis* has a life cycle which is tailored to the temporal dynamics of seasonally dry streams. They usually hatch before drought commences and enter an aestivation phase as adults to overcome the waterless period. Their aquatic larvae are, however, able to survive in case of early stream drying, but to date, the mechanisms driving this survival ability have not been studied.

In this project, we investigate the underlying genetic responses and candidate genes for desiccation tolerance in larval *M. lateralis* with an emphasis on potential drought effects on respiratory pathways. We perform common garden experiments to simulate drought conditions, using samples from *M. lateralis* populations taken from permanent as well as temporal streams in the Hessian region in Germany (spring 2015). The experiment simulates three main states: wet, moist and dry. In a first test of our system we compare gene expression profiles of three individuals under each of these states using Illumina-based Massive Analysis of cDNA Ends (MACE).

Our first results show large differences in gene expression between the three studied phases with many genes exhibiting gradual up- or down-regulation across them. Up-regulation was primarily found in genes involved in respiratory mechanisms and desiccation protectants whereas down-regulated genes were important for lipid and carbohydrate metabolic processes.

#### **4: Behavioral response of adult caddisflies (Trichoptera) to blue and green light-emitting diode (LED) lamps**

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Light traps have evolved as powerful sampling tools in both terrestrial and aquatic habitats. This method is especially useful for aquatic insects such as Trichoptera, and Diptera (especially Chironomidae) are often caught in large numbers. Black fluorescent lamps are one of the most effective lamps for light traps. These aquatic insects are known to be attracted by ultraviolet (UV) light (Positive phototaxis). Our previous study indicated that significantly more adult Trichoptera were attracted using a white fluorescent lamp (including UV) than using a white LED lamp (not including UV). However, there was no significant difference between the attracted number of Hydroptilidae spp. with a blue LED (peak wavelength: 470nm) and black light (BL) lamps (including UV) during the present study. In addition, many adult chironomids were also attracted to blue and green LED (peak wavelength: 520nm) lamps. These results suggest that some aquatic insects were attracted to both the BL lamp and the blue lamp.

#### **5: Analysis of heavy metals concentration in whole bodies and in anal papillae of *Hydropsyche angustipennis* larvae**

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Analyses presented in this study concern the concentration of heavy metals in larval bodies as well as in anal papillae of *H. angustipennis*. This species is a metallotolerant, recorded in waters contaminated by domestic wastewater or/and rainwater outflowing to rivers along storm drains. *H. angustipennis* owes its eurytopic character to the presence of anal papillae – organs that fulfil osmoregulation and detoxification functions. When the concentration of contaminants in water exceeds caddiesflies' physiological capacity of ions compensation, the electrolytes are absorbed by body surface. To reduce this adverse effect, reduction of individual chemicals occurs in the epidermal cells of anal papillae. This process reduces excess of ions in the bodies. Excessive exploitation of these structures leads to their darkening or deformation.

The aim of this study was to evaluation of deformation of osmoregulation organs as well as the concentration of metals in whole larval bodies and in anal papillae, depending on the level of water contamination in small urban streams.

For the present study, larvae of *H. angustipennis* (5<sup>th</sup> instar) were collected from January to May in nine sampling sites located on five streams differing in contamination level and anthropogenic transformations of the riverbeds. Simultaneously, basic environmental parameters and chemical composition of water were recorded and analysed. We conducted analyses of heavy metals concentrations in the whole bodies without starving them in the laboratory. In the event of content of heavy metals in osmoregulation organs IL 251 atomic absorption spectrophotometer (AAS) was used. Larvae were studied with division of normal and irregularities of anal papillae.

Our study confirmed the relationship between the concentration of part of heavy metals in the larval bodies and the level of contamination in water. The share of larvae with normal anal papillae was always higher in poorly contaminated river stretches. Generally, the presence of heavy metals in anal papillae was reflected in their concentration in larval body tissues. Irregularities concerning the darkening or reduction of anal papillae were correlated with the concentration of heavy metals in the epidermal cells of these organs.

## 6: Emergence of Limnephilidae from subalpine Findley Lake after early and late thaws

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*Halesochila taylori* (Banks) (Limnephilidae), *Clistoronia magnifica* (Banks) (Limnephilidae) and other Trichoptera were collected in floating emergence traps on oligotrophic Findley Lake in the coniferous forest of the Cascade Mountains, USA. They had their maximum emergence from the sites that thawed before the rest of the lake, the sites that had the most detritus from the forest and the solid bottom. More Trichoptera emerged from deeper water after an early thaw than after a late thaw.

In 1973 after an early thaw on June 7, *H. taylori* had its maximum emergence from the 1.8 to 11.7 m deep sites, but in 1974 after a late thaw on July 31, it had its maximum emergence from 0.5 to 4.5 m. The biomass that emerged in 1973 was 7.2 times as much as in 1974.

Most *C. magnifica* emerged from 0.5 to 11.7 m in 1973, but from only 0 to 1.8 m in 1974. The biomass that emerged in 1973 was 3.2 times as much as in 1974.

*Limnephilus santanus* Ross (Limnephilidae) had its maximum emergence from the 1.8 m deep detritus in 1973 and from the shore in other years.

*Hesperophylax designatus* (Walker) (Limnephilidae) emerged from the sandy shore and the 11.7 m deep sand.

## 7: A Preliminary Study for the Determination of Physicochemical Parameters and Trichoptera Fauna of the Araç Stream (Kastamonu, Turkey)

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**Introduction:** The Araç stream is one of arms forming to the Filyos stream which arising from the foot of Ilgaz Mountain, pass through the İhsangazi and Araç district of Kastamonu, and spreads along the Karabük plains. This study aimed to determine the physicochemical characteristics and Trichoptera fauna of the Araç Stream.

**Material and Methods:** Trichoptera fauna (aquatic stages and adults) were sampled in 7 sites along the Araç stream (Kastamonu) in different seasons in 2013. Surber sampler is used for sampling larvae and light trap (6 W BLB fluorescent light bulb) for sampling adult. Some physicochemical properties of Araç stream

(temperature, pH, electric conductivity, dissolved oxygen, dissolved oxygen saturation%, hardness) were measured and the effect of these parameters on distribution of Trichoptera were investigated.

**Results:** In our study, the pH, water temperature, conductivity, dissolved oxygen, total hardness values of Araç Stream were determined on the basis of stations and seasons. 1223 larvae and 624 adults (166 male and 458 female) were collected from Araç stream between April to October in 2013. As a result of identification of the collected samples it was determined in 21 taxa of 9 genera belonging eight different families (Brachycentridae, Hydropsychidae, Hydroptilidae, Lepidostomatidae, Leptoceridae, Limnephilidae, Psychomyiidae, Rhyacophilidae) of Trichoptera order.

**Discussion and Conclusion:** 450 larvae and 24 adults collected in the spring sampling. The Hydropsychidae family has been the dominant family with 452 individual in spring. The *Hydropsyche botosaneanui* has been the dominant species with 258 individual in spring. 174 larvae and 233 adults collected in the summer sampling. The Hydropsychidae family has been the dominant family with 313 individual in summer. The *Hydropsyche bulbifera* has been the dominant species with 61 specimen in summer. 599 larvae and 367 adults collected in the autumn sampling. The Hydropsychidae family has been the dominant family with 819 individual in autumn. The *Hydropsyche botosaneanui* has been the dominant species with 365 specimen in autumn. It has been identified as the autumn season with 599 larvae and 367 adults, when most individuals found the Trichoptera for Araç stream.

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**Keywords:** Benthic macroinvertebrates, Trichoptera, Araç stream, Kastamonu, Turkey

#### **8: Leaf litter decomposition in lowland springs (Central Poland) and selective feeding of some shredding caddis larvae (Trichoptera: Limnephilidae)**

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Caddisfly larvae are very important component of the entomofauna associated with freshwater springs. It can be assumed that their abundance and diversity may affect the time and efficiency of decomposition of different leaves. Our aim was to assess: 1) the health/ecologic condition of different springs on the basis of leaf litter decomposition rate, 2) the caddis species contribution to leaf litter decomposition, 3) the food preferences and the amount of processed leaves of the most abundant caddis shredder.

Research was carried out at different springs of Łódź region. To assess leaf litter decomposition rate, mats with different leaf species (*Quercus petraea* L., *Acer pseudoplatanus* L., *Quercus rubra* L. i *Alnus glutinosa* Gaertn.) were constructed. One square meter of leaves was used in each mat. Food preferences and the amount of processed leaves were checked using *Chaetopteryx villosa* larvae in the laboratory. To reveal the food selected most frequently by larvae, plates with small squares of different leaves species were prepared. They were fed with 4cm<sup>2</sup> leaf-squares and the amount of consumed food was evaluated every two days. To assess larvae ability of processing leaves, 140 fifth-instar larvae were reared separately. Mats have been processed for 6 to 14 weeks in 2013 and 2014. The fastest decomposition rate had *A. glutinosa* and it was 6 weeks, while *Q. rubra* decomposition time length was 14 weeks. The highest number of caddis appeared on *Q. petraea*, which is an invasive species in Poland considered as threat for native fauna and flora. Nevertheless, its decomposition time was only slightly shorter than *Q. rubra* and lasted 12 weeks. The decomposition rate of *A. pseudoplatanus* in 2015 was almost twice faster than in previous years. In all chosen springs the decomposition of *A. pseudoplatanus* lasted no longer than 4 weeks while in 2013 and 2014 the time of decomposition was 8 weeks. The most abundant shredders were *C. villosa* and *Potamophylax nigricornis*. Laboratory experiments indicated *A. glutinosa* as preferred leaf species (62,81% of all choices), followed by the leaf of *A. pseudoplatanus* (38,12% of all choices). The average leaf surface consumed by one larva per 24 hours was 0,32cm<sup>2</sup> and the average leaf surface consumed by one larva during experiment was 25,632 cm<sup>2</sup>. This can lead to conclusion that 1) leaf species as well as abiotic factors (especially water temperature) influence decomposition rate, 2) *C. villosa* fifth-instar larvae are effective shredders and are able to process up to 57,6 cm<sup>2</sup> leaves of *A. glutinosa*, 3) *A. glutinosa* and *A. pseudoplatanus* are preferred by *C. villosa* larvae as their main source of food.

**9: Current Water Environment in urban Sri Lankan wetlands: Case study in Diyawannawa wetland**

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The rapid pace of urbanization, economic growth as well as un-controlled migration especially in urban areas are now causing significant adverse impact on wetland environment. Wetland ecosystems are dynamic and heterogenic, which can exhibit substantial spatial and temporal variability in soil properties which can be influenced by the land use pattern of the area. This variability can have important consequences on wetland biota and biogeochemistry. High population densities and continued economic growth and industrialization are causing serious environmental damage in urban wetland areas in Sri Jayawardenapura administrative capital of Sri Lanka. The main objective of the study was to identify spatial variability of soil and water chemical and physical parameters in a land use gradient in the Diyawannawa wetland located in the Sri Jayawardenapura urban area. Water and soil samples were collected systematically from 20 locations in wetland twice a month from November 2013 to January 2014. The study reveled that the area is dominated by clay soil type but top and bottom layers are dominated completely different soil characteristics. Spatial distribution of water quality parameters could be identified using developed preliminary GIS maps for the study area. Lower pH values are in the wetland area while highest pH values are recorded near to the settlement areas. The lower pH values indicate inherent acidic nature of wetland soils. In chloride distribution map it was observed that chloride content in water in wetland areas are much lower than the other areas. Nitrate content is slightly higher near settlement areas may be because of increased human activities. Comparatively Phosphate condition indicates the same distribution like Nitrates. Interestingly Sulphate is much concentrated in wetland water proving that wetlands are sulphate sinks as well as pollution filters.

key words: soil, pH, Chloride, sulphate, Nitrate

#### Taxonomy

**10: Taxonomic study of *Oxyethira janella* (Hydroptilidae) species-group using both molecular and morphological data**

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*Oxyethira* Eaton currently includes over 100 described species, but this number is still low, because there are still several undescribed species, at least in South America. Three species comprise the *Oxyethira janella* species-group: *O. janella* ranging from United States to Dominican Republic, *O. tica* Harris & Holzenthal from Mexico to Brazil, and *O. puertoricensis* Flint recorded from Puerto Rico. These species are quite similar in their general aspect of male genitalia. In this work, we identified a new species of this group based on both morphological and molecular data. Moreover, we provide redescriptions of *O. janella* and *O. puertoricensis*. In order to evaluate the genetic diversity of these species we analyzed 66 sequences of cytochrome c oxidase I (COI) and 50 of carbamoylphosphate synthetase (CAD) with a neighbor-joining clustering algorithm in MEGA 6 and Bayesian inference in MrBayes 3.2. Sequences from almost all individuals of each species grouped in monophyletic clades, except for individuals previously identified as *O. janella* based on male genitalia. These individuals were recovered in two lineages: one including specimens from the United States (Florida and Virginia), which was always recovered as sister to *O. puertoricensis*, and another with specimens from Brazil (Piauí). Genetic divergences between pairs of each of these two lineages ranged from 11.8% to 12.4%, whereas intraspecific divergences of the other species had a maximum of 6.3%. After a reanalysis of the morphology of those specimens we found differences that can be of use to diagnose and describe the Brazilian lineage as a separate species.

**11: Immature and adult associations of *Nectopsyche* Müller (Leptoceridae) from mountaintops of Southeastern Brazil using DNA barcodes**

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Caddisfly larvae are commonly used for biomonitoring of freshwater habitats as general indicators of water quality. Despite their great abundance and importance of freshwater environments, few species of caddisflies from Brazil have their larval stages described. *Nectopsyche* Müller, 1879 (Leptoceridae) includes 58 described species, being this genus limited to the Nearctic and Neotropical regions. In Brazil, *Nectopsyche* is represented by 19 species and their larvae, despite of being abundantly collected in ecological biomonitoring studies, cannot be identified to species level. Although, recent studies use DNA barcodes (sequences of cytochrome *c* oxidase subunit I -- COI) to associate known adults with unknown larvae of Trichoptera, for the Neotropical Region, and specifically for the Brazilian fauna, this kind of study is still lacking. Therefore, the aim of this study was to associate adult males and larvae of *Nectopsyche* found in montane areas (above 1,000 m.a.s.l) in Southeastern Brazil, in order to describe the associated larvae. Adults and larvae of *Nectopsyche* were collected in six national parks, namely P.N. do Caparaó (CAP), P.N. da Serra da Bocaina (BOC), P.N. da Serra da Canastra (CAN), P.N. da Serra do Cipó (CIP), P.N. da Serra dos Órgãos (SOR), and P.N. do Itatiaia (ITA). A neighbor-joining (NJ) analysis using Kimura-2-parameter (K2P) pairwise divergences was made with 49 sequences of COI (475 bp) of *Nectopsyche* larvae and adults. These sequences were from males of seventeen different *Nectopsyche* species and 13 larval morphotypes. A maximum intraspecific threshold of 14% was defined, based on comparisons of morphologically identical males with high intraspecific divergences, such as *N. muhni* (14.0%), *N. aff. ortizi* (of 9.2%), and *N. splendida* (13.4%), resulting in 21 specific lineages of *Nectopsyche* with bootstrap support above 95% (when more than one specimen was included). Of those, eight lineages included male and larval specimens (10 morphotypes). These larvae were identified as *N. aureovitatta*, *N. aff. dorsalis*, *N. maculipennis*, *N. aff. muelleri*, *N. aff. ortizi*, *N. pantostica*, *N. punctata*, and *N. separata* and were photographed and described. Interspecific divergences within *Nectopsyche* varied from 11.6% to 26.6%. As expected, some species showed higher values of divergences between individuals from different mountain ranges, such as *N. aff. ortizi* between BOC and ITA or *N. muhni* between BOC and CAP. But, at the same time, other species had individuals from different populations sharing the same haplotype, such as *N. aff. muelleri* from SOR and CAP, or with very low divergence values, such as *N. separata* from ITA and BOC (1.3%).

## **12: Associating larvae and adults of Neotropical caddisfly genus *Synoestropsis* Ulmer (Trichoptera: Hydropsychidae) using DNA mitochondrial sequences**

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Currently, with 10 described species *Synoestropsis* Ulmer, 1905 is the only genus of Neotropical macronematines that belong to Polymorphanisini tribe, with occurrence since Argentina until Mexico. (Flint *et al.* 1999). Their adults can be recognized from the other macronematines by the palps absent and the presence of a connection between Rs and M veins of the forewings. (Flint 1974; 1978; Barnard 1980). The larvae of the genus, firstly described by Roback (1964) are poorly studied and the understanding of its morphological characteristics as well as biologic aspects are few known. They can be distinguished from the other macronematines genera by the head and thorax very long, the expanded forefemur that forms a prehensile structure with the foretibia (Pes *et al.* 2005). Currently the only species which have the larval stage described is *Synoestropsis furcata* Flint, 1974 (Calor 2008), however this association was established indirectly through adults and larvae collected in the same collecting site. The aim of this study was to associate larvae and adults through molecular data as well as describe the larvae of different species of the genus *Synoestropsis* found while performing the work. In this study, we collected individuals from several Brazilian states and preserved in 100% alcohol. Of these specimens were performed DNA extraction, amplification and sequencing of COI fragments of larvae and adults for associating in specific level. The sequences were aligned properly and analyzed in the MEGA program with Neighbor-joining method and as association criteria were used in accordance Zoul *et al.* (2007). Some species have also been associated through creation of immature. In total five morphotypes larvae were identified, and through the COI data it was possible to perform four larvae and adults associations (*Synoestropsis pedicillata* Ulmer, 1905, *Synoestropsis grisoli* Navás, 1934, *S. furcata* e *Synoestropsis* sp. 1. One of morphotypes was not associated because it was not possible to amplify the sequences of COI and were not collected live larvae that would

allow the creation (*Synoestropsis* sp. 2). Here, we propose a new diagnosis for *Synoestropsis* genus and described the five morphotypes/species found. Among the main diagnostics characters, were the pattern of spots on the head and thorax, the format of the foretrocantin apicoventral region as well as the presence and arrangement of the setae and the format of the forefemur. Based on these characteristics has been proposed an identification key to the species found.

**13: The immature stage of the Neotropical caddisfly genus *Centromacronema* Ulmer, 1905  
(Trichoptera: Hydropsychidae)**

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*Centromacronema* Ulmer, 1905 is one of the macronematines endemic genera of Neotropical region. Currently with 12 described species it is considered a problematic genus in the family, due the wide variation in the pattern of wings spots, as well as the absent of diagnostic characteristics in male genitalia, hindering the identification and the delimitation of the morphological interspecific limits. The immature stages are still enigmatic. Larvae described by Muller and Marlier were indicated as belonging to genus, however this associations were not confirmed (Flint 1978) and the immature remain unknown yet. The aim of this study was describe the larval stage of the genus *Centromacronema* through specimens of *Centromacronema obscurum* Ulmer, 1905 collected in the Espírito Santo state, associate through sequences of mitochondrial DNA (COI). Adults and larvae were collected in the same site, in a well-preserved Atlantic Forest fragment in the Espírito Santo state. Adults were collected with Malaise trap (Towner style) and were identified through comparison with reference specimens identified by Oliver Flint that are deposited in the Coleção de Invertebrados do INPA. Larvae were collected through manual collection with the aid of aquatic insect net. Of this specimens were performed DNA extraction, amplification and sequencing of COI fragments of larvae and adults for associating of these different life stage of the genus. The sequences were aligned properly and analyzed in the MEGA program with *Neighbor-joining* method and as association criteria were used in accordance Zoul *et al.* (2007). The larva of *Centromacronema* can be distinguished of the others by the following set of characteristics: (1) body heavily covered by long setae; (2) eyes reduced; (3) stridulation structure present; (4) notos thoracic partially divided averagely, with concave anterior and posterior lobes; (5) metanotum with reduced posterior margin, covering partially the dorsal region of the thorax; (6) oretrocantin bifid, dorsal branch short pointed apically, ventral branch long and rounded apically; (7) anal leg very elongated. *Centromacronema* larvae are similar to *Macronema*, both have elongated anal legs, and abdominal gills bifurcated from the base with thin ramification from the two main branches, however they can easily be distinguished, among other characteristics by the foretrocantin format, that in *Centromacronema* in bifid and in *Macronema* is simple. According to these characteristics larvae described by Muller and Marlier and proposals as belonging to *Centromacronema* have the characteristics that enable them to identify how *Macronema*. Roback (1964) described a larva which he called Hydropsychidae sp. 4 morphologically similar to the larva that here is described as *Centromacronema*. Thus despite never having been safely associated with the genre had been shown previously.

**14: The genus *Helicopsyche* (Trichoptera: Helicopsychidae) in Brazil: the utility of setal warts morphology for recognizing species.**

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The family Helicopsychidae currently includes two genera, the monotypic *Rakiura* McFarlane and the cosmopolitan *Helicopsyche* von Siebold with about 250 species. The genus *Helicopsyche* is subdivided into six subgenera: the nominotypical one, *Cochliopsyche* Müller, *Feropsyche* Johanson, 1998, *Galeopsyche* Johanson, *Petrotrichia* Ulmer, and *Saetotrichia* Brauer. Among these, *Cochliopsyche* and *Feropsyche* are endemic to the Neotropics. To date, 19 *Helicopsyche* species are known from Brazil, 9 belonging to *Cochliopsyche* and 10 belonging to *Feropsyche*. *Helicopsyche* species are distinguished from each other based on features of male genitalia, as typical for caddisfly. However, limits between some species are

difficult to define, since variation in male genitalia can be very subtle. The present study aims to characterize the morphological variation of setal warts on head and thorax of *Helicopsyche* species, in order to evaluate the utility of these patterns for identifying species in this genus. We analyzed 92 specimens of 9 *Helicopsyche* species found in Brazil, including 2 new species of Southeast region. The species were identified based on original description and male genitalia comparison, as usual. Among species examined, we found consistent variations on setal warts morphology, for example, presence or absence, position, and shape, particularly for those on head. It is still necessary to study more species, including representatives from other regions, but these morphological features can help in species identification and delimitation, before trying more expensive tools, for example DNA sequencing.

### **15: New species of *Metrichia* Ross from Brazil and phylogeny of Ochrotrichiinae based on DNA sequences**

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Hydroptilids constitute the most diverse family of Trichoptera with over 2,000 known species and undescribed species still are common to collect, particularly in Neotropics. Currently, the family is divided into 6 subfamilies and includes about 75 genera. However, several of these genera are poorly defined and their relationships within the family are not established yet. To date, only one *Metrichia* species is known from Brazil. Based on material collected in different regions of the country, 19 new species were discovered, some of them widely distributed. COI sequences (DNA barcoding region) were obtained from multiple specimens for 9 of these new species. *Metrichia* species described from other countries and other Ochrotrichiinae species were also sampled. Pairwise distances (p-distances) for 52 COI sequences were calculated in MEGA 5.0 and used to compute a neighbor-joining tree. The lineages recovered with DNA barcode analysis agreed with species defined with morphology. Besides, considering the unclear relationship among Ochrotrichiinae genera, a phylogenetic analysis was carried using DNA sequences from 3 coding genes: CAD, COI, and POL-II. The combined matrix included 2,133 characters of 6 genera and 27 species of Ochrotrichiinae as ingroup: *Angrisanoia* Ozdikmen (1), *Metrichia* (13), *Nothotrichia* Flint (2), *Ochrotrichia* Mosely (6), *Ragatrichia* Oláh & Johanson (1), *Rhyacopsyche* Müller (4); and 9 other Hydroptilidae species as outgroups. Data were analyzed using Bayesian Inference in MrBayes 3.2. The subfamily was recovered as monophyletic with high support (PP=0.99); *Metrichia*, *Ochrotrichia*, and *Rhyacopsyche* were also recovered as monophyletic groups. On the other hand, *Nothotrichia* was non-monophyletic, with *N. tupi* Holzenthal & Harris as sister group to *Angrisanoia cebollati* (Angrisano) (PP=1.00) and *N. cautinensis* Flint as sister group to a new species of *Ragatrichia*. These results represent the first attempt to assess relationships within genera and species of Ochrotrichiinae, additional taxa and characters (e.g. other genes or morphology) still is necessary to understand the composition and evolution of this group.

### **16: Philopotamidae (Trichoptera) of Shikoku, southwestern Japan**

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Shikoku is the 4th largest island of the Japanese archipelago, having an area of 18,301 km<sup>2</sup>. It is close to southwest Honshu, the largest island of the archipelago, across the Inland Sea. Thousands of philopotamid's from throughout Shikoku were examined resulting in a total of 28 species: 1 species of *Chimarra*, 7 species of *Dolophilodes*, 8 species of *Kisaura* and 12 species of *Wormaldia*. Five new species (3 *Kisaura* and 5 *Wormaldia*) are described. Of these, 2 *Kisaura* and 3 *Wormaldia* species are endemic to Shikoku. The other 23 species are distributed on both Shikoku and Honshu.

**17: Two new species of *Cernotina* Ross (Trichoptera: Polycentropodidae) from Ecuador**

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The genus *Cernotina* Ross, 1938 reaches its highest diversity in the Neotropics, but there are still many biomes inside this biogeographic region with few fauna surveys of caddisflies. In this study, two new species of *Cernotina* are described from the Ecuadorian Amazon. This is the first record of the genus in Ecuador.

**18: Review of the genus *Beraea* Stephens (Trichoptera: Beraeidae) in North America, with the description of a new species from Florida**

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Three species of the Holarctic genus *Beraea* Stephens were previously recognized in North America: *Beraea nigritta* Banks and *B. fontana* Wiggins in the northeast, and *B. gortebia* Ross in the southeast. Herein, we describe a fourth species, *B. wigginsi* n. sp., collected from a steephead stream in northern Florida. As is the case with other North American beraeids, the new species occurs in seepage-spring habitat. In addition to this new species, males and females of the other North American species of *Beraea* are illustrated, and diagnoses are presented in order to facilitate the identification of both males and females of each species.

**19: Larval description of *Rhyacophila osellai* Malicky, 1981 (Rhyacophilidae, Trichoptera) with some notes on its habitat**

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The unknown larva of *Rhyacophila osellai* Martynov, 1981 is described and its important diagnostic features are illustrated. The *Rhyacophila osellai* mature pupae were identified by genitalia and larvae were associated with the pupa by using metamorphotype method. Larvae of caddisflies are used in biomonitoring studies effectively, so descriptions of unknown larvae are very important to improve the knowledge on relationships between larvae and water quality.

**20: Taxonomic review of the Korean Philopotamidae with discussion on the *Kisaura aurascens*-group**

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The caddisfly family Philopotamidae consists of 1,068 species worldwide wherein majority of the species are found in tropical areas. In Korea, 7 species belonging to 4 genera were recorded (*Chimarra tsudai* Ross, 1956, *Wormaldia corana* Kumanski, 1992, *Wormaldia longicerca* Kumanski, 1992, *Kisaura aurascens* Martynov, 1934, *Kisaura tsudai* Botosaneanu, 1970, *Dolophilodes distinctus* Walker, 1852, and *Dolophilodes mroczkowskii* Botosaneanu, 1970) and two undetermined species were described from the larval stage (*Dolophilodes* KUa Yoon & Kim, 1998, and *Wormaldia* KUa Yoon & Kim, 1998). The newly recorded male adult of Korean *Kisaura* sp. resembles that of *Kisaura aurascens* Martynov, 1934, but lateral

processes of tergum X are curved apically from the lateral view and preanal appendages are narrower than those of *K. aurascens*. *Kisaura kisoensis* Tsuda, 1939 was synonymized with *Kisaura aurascens* Martynov, 1934 by Ivanov (1997), but Kuhara (1999) suggested that variations of both species should be studied because description of Russian *K. aurascens* is not congruent with the description of the synonymized *K. kisoensis*. Discussion on the *Kisaura aurascens*-group including *K. aurascens*, *K. kisoensis*, *K. tsudai*, and Korean *Kisaura* sp. is provided in this paper.

**Keywords:** Philopotamidae, *Kisaura kisoensis*, *Kisaura aurascens*, Korea, new species

**21: Evidence for cryptic species of the Brazilian *Barypenthus* Burmeister (Odontoceridae)**

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*Barypenthus concolor* Burmeister, 1839 is considered the sole valid species in its genus. Most geographical records of this species are from Southeastern and Southern Brazil states Espírito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ), São Paulo (SP), and Paraná (PR), however, recently this species was recorded from Bahia (BA, Northeastern Brazil), based on one male specimen. Larvae are found in pool areas of clean first to third order streams, usually above 600 masl, and adults are active during the day between the months of January through April. In a review of the genus, Paprocki (2002) considered all six other described species names in *Barypenthus* as synonyms of *B. concolor*, even though some slight morphological variation in the shape of the male preanal appendages and the female vaginal apparatus was observed in available specimens. In order to investigate the genetic diversity found in *B. concolor* populations and try to relate genetic units to morphological variants, we have so far, sequenced 657bp of the mitochondrial cytochrome oxidase I of 68 specimens of *B. concolor*. These specimens were collected in the following mountain ranges in Brazil: Serra do Mar (Serra da Bocaina, SP; Nova Friburgo, RJ; Serra dos Órgãos, RJ); Serra da Mantiqueira (Itatiaia, RJ; Caparaó, ES); Serra do Espinhaço (Itabirito, Serra do Caraça, Serra do Cipó, MG); Serra da Jibóia (BA); Serra da Canastra (MG); and Pirenópolis (GO). Based on a preliminary Neighbor-Joining analysis of K2P pairwise distances, five monophyletic lineages with high bootstrap support were recovered, each with a maximum of 6.6% intralineage divergence. Pairwise distances between these five lineages ranged from 7.9–18.8% (mean=15.2%), distances comparable to interspecific divergences amongst other Odontoceridae, such as *Marilia* Müller and *Psilotreta* Banks. Additionally, a congruent separation of two of these lineages is also corroborated with the analysis of a smaller sampling of 21 sequences of nuclear carbamoyl-phosphate synthetase II (CAD, 837bp). A morphological study conducted on male representatives of three of these lineages, found characters to diagnose at least three of these species, including in the relative length of the inferior appendages relative to preanal ones, however, very few specimens were studied so far. Thus, these five lineages are herein treated as cryptic species. Two of these cryptic species are restricted to Serra dos Órgãos, one to Serra da Jibóia, and another one to Serra da Canastra and Pirenópolis. All remaining specimens belong to the more widespread species, including those from type-localities of *B. concolor* and four of its six synonyms (other two synonyms without precise type-locality). A median-joining network of haplotypes of the latter lineage of *B. concolor* suggest high haplotype diversity and higher gene flow between populations of Nova Friburgo, Itatiaia, and Serra da Bocaina, of the populations studied. Further completion of CAD sequencing and the inclusion of additional specimens from the less sampled localities will be conducted in the future.

**22: Taxonomic Notes on the Larval Description of *Phraepsyche* Malicky and Chantaramongkol, 2000 (Odontoceridae), including a larval description of *Phraepsyche darnous* Malicky and Sompong, 2000**

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*Phraepsyche* has been described by Malicky and Chantaramongkol since 2000 from Wiang Kosai National Park in the northern part of Thailand, based on adult female specimens. In addition, the larvae and larval cases of *Phraepsyche* are described for the first time. Larval description of *Phraepsyche darnous* Malicky and Sompong, 2000 is described and some taxonomic, zoogeographic and ecological notes on this species are included. The presence, number and characteristics of the sclerites on metasternum and the tortoise shape of larval case can be used to identify the species found in Thailand.

**Keywords:** Trichoptera, Odontoceridae, *Phraepsyche*, Larva, Thailand

**23: *Achorophyche duodecimpunctata* (Navás), 1916 (Trichoptera, Leptoceridae), a baby a hundred years!**

Ana Maria Pes, Neusa Hamada and Ralph W. Holzental

The genus *Achorophyche* Holzenthal, 1984 is a nomobasic genus, endemic of South America. The species after being described in the genus *Setodes* transferred for the genus *Brachysetodes*, the genus *Achoropsycche* was created to accommodate the species. Larvae and pupae of *A. duodecimpunctata* were associated with adulthood through creation. Larvae were collected in small streams of the Amazon basin, and maintained in the laboratory in boxes with bryophytes and water, until the emergency. In Northern Brazil region, adults are collected in traps to large rivers such as the Amazonas, Negro and Branco rivers, though but some individuals collected in small streams. The larvae however were always collected in small streams, in places of lentic waters and background with roots and a fine sediment. The larva is small (5 mm) is characterized in that it has a keel side of the Fathers, robust antenna, long triangular ventral apodeme dividing the gena; pronotum with previous sharp and serrated margin, mesonotum with a split board in half lengthwise; metanotum without sclerotic plaques. The main difference from other genera described, is the dorsal esclerito the IXth abdominal segment and the pair of side esclerito anal claw, with the posterior margin with long spines, forming an armor. Case of larvae constructed with very fine and uniform grains of sand. House pupa is added a lighter and fragile sand line.

**24: A new species of *Nyctiophylax* Brauer, 1865 and description of larva and pupa of *N. neotropicalis* Flint (Polycentropodidae) from Brazil**

Ana Maria Pes; Neusa Hamada; Gleyson R. Desidério-Gomes; Lucas Marques de Camargos; Ralph W. Holzenthal

*Nyctiophylax neotropicalis* Flint is widely distributed in the Neotropics, from Argentina to Suriname. Recent phylogenetic studies suggest this species might not be sister to clades of *Nyctiophylax* from other regions, indicating it probably belongs to another genus of Polycentropodidae. Larvae and pupae of *N. neotropicalis* were collected in Presidente Figueiredo, Amazonas in 2000-2014 and Rio Grande do Sul in 2006. Specimens of *Nyctiophylax* sp. nov. were collected in June 2007, Reserva Ducke in Manaus, Amazonas, and were reared in laboratory. The shape of the claws of anal legs of the larvae of *N. neotropicalis* and *Nyctiophylax* sp. nov. is similar, suggesting close relationship between these species. The larvae of *N. neotropicalis* bears 2 pairs of spines in the inner margin of the claws of the anal legs. The larva of *Nyctiophylax* sp. nov. characterized by being dorsal-ventrally flattened and by having the claw of the anal legs with 1 pair of spines on the inner margin. The larva of *Nyctiophylax* sp. nov. builds under silk and sediment on leaves of aquatic macrophytes in lentic sites riverbeds while the larvae of *N. neotropicalis* build shelters on very resistant silk rocks and streams and areas of open rivers in current water.

**25: Old News: The Hunt for *Phylocentropus auriceps* Larva (Trichoptera: Dipseudopsidae)**

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Five species of *Phylocentropus* are known from North America. The larvae of *Phylocentropus carolinus* Carpenter, *P. lucidus* (Hagen) and *P. placidus* (Banks) have been described. The immature stages of *P. auriceps* (Banks) and *P. harrisi* Schuster and Hamilton remain undescribed. *Phylocentropus harrisi*, a sister species to *P. placidus*, is known only from the type locality in southern Alabama and from an additional location in southwestern Texas. While unknown, the larva of this species is likely similar in habitat and morphology to that of *P. placidus*. The male and female genitalia of *P. auriceps* are very different from that of the other four North American *Phylocentropus* and like the adults the larvae are very distinctive. Here we describe the larval morphology and offer observation on the habitat and retreat structure of *P. auriceps*.

**26: New species of *Allomyia* Banks from the Western United States (Trichoptera: Apataniidae)**  
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New *Allomyia* species from the western United States are described. The majority of these species were collected from small headwater, high altitude streams on isolated mountain ranges. Distribution for all North American species is portrayed.

**Keywords:** Trichoptera, Apataniidae, *Allomyia*, distribution, new species.

**27: New species of the Neotropical genus *Ascotrichia* (Trichoptera: Hydroptilidae)**  
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Flint (1983) established the genus *Ascotrichia* for two species, *Ascotrichia frontalis* and *A. surinamensis*, from eastern South America. Since then, a single new species has been described from Venezuela by Oláh & Flint (2012). The genus appears to be endemic to eastern South America, occurring in Brazil, Paraguay, Uruguay, and Venezuela. Larvae are unknown. Adults may be large and have conspicuous patterns on the wings. A new species from Brazil is described and illustrated here.

**28: Update on the tropical Southeast Asian Hydropsychidae with description of new species**  
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The caddisfly family Hydropsychidae is considered as the third largest family of Trichoptera wherein approximately 1,500 species have been recorded up to date. Due to their abundance and wide range of environmental tolerance, they are important components of freshwater ecosystems and are used in diverse ecological and biomonitoring programs. In tropical Southeast Asia, 12 genera are currently recognized in the family belonging to 3 subfamilies, Diplectroninae, Macronematiniae, and Hydropsychinae. Taxonomic studies were conducted mostly in Vietnam, Thailand, Indonesia, Malaysia, and the Philippines by Malicky, Chantaramongkol, Mey, Oláh, and Johanson. As a result of these studies, a total of 356 Hydropsychidae species were recorded in the region. In this study, a historical review of the tropical Southeast Asian Hydropsychidae is provided with additional reports of new species using materials collected from diverse localities in tropical Southeast Asia since 2009.

**Keywords:** *Hydropsychidae*, Trichoptera, tropical Southeast Asia, new species, historical review

Phylogeny

**35: Morphological phylogeny of Neotropical species of *Oecetis* McLachlan, 1877 (Trichoptera: Leptoceridae)**

Fabio B. Quintero & Eduardo A. B. Almeida

*Oecetis* is a cosmopolitan species-rich genus within Leptoceridae. Currently, it comprises about 500 valid species, which tend to be very abundant, especially in large rivers. McLachlan described *Oecetis* using the apparently unbranched M vein on forewings as a diagnostic character; and seven species of *Setodes* were initially included in the new genus. In the Neotropics, *Oecetis* comprises 53 valid species. They are taxonomically divided in a few species-groups based on morphological similarity. Although a great part of the genus biodiversity has been revealed in the Neotropics, we do not know even if the proposed groups and the genus constitute a natural group. In this study, we propose the first comprehensive phylogenetic hypothesis for the species recorded in the Neotropical region based on morphological characters within a cladistic paradigm. We built a matrix with 56 terminals (14 as outgroups 42 as ingroup) and 74 characters, and then used heuristic tree-search algorithms with equal and implied weights approaches to build cladistic hypotheses. *Oecetis* was found to be monophyletic and the forewing venation was indicated as its synapomorphy. Additionally, some major species-groups (e.g., the *falicia*, *punctata*, and *avara* groups) had their monophyly also supported. Interestingly, the Neotropical species were not recovered as monophyletic, as suggested by previous authors. In a strict vicariant biogeographic scenario, some major lineages within the genus could have differentiated before the breakup of Pangea (because they can be found in the Americas and Europe), but that would require an older age for *Oecetis* than the most recent molecular estimation (around 70 Mya). A more comprehensive data matrix using molecular and morphological characters is being constructed and it may provide more new insights about the phylogenetic relationships, divergence ages, and historical biogeography of *Oecetis*.

**36: Phylogeny of the genus *Alterosa* Blahnik (Philopotamidae) based on multiple gene sequence data**  
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The endemic Brazilian genus *Alterosa* was proposed by Blahnik (2005) to include two previously described species, *Dolophilodes (Sortosa) sanctipauli* Flint and *Dolophilodes (Sortosa) marinonii* Almeida & Duarte, and 20 new species. More recently, 17 new species were described, raising the total to 39. These species are usually found in Atlantic Forest pristine headwaters, rapids of streams or small rivers. Blahnik (2005) proposed informally five species groups: *falcata*, *guapimirim*, *holzenthalii*, *marinonii* e *sanctipauli*. DNA sequences were used in order to hypothesize the phylogenetic history amongst species of *Alterosa* and revise the species group classification. The complete DNA sequence dataset included 1841 bp of two mitochondrial genes (16S rDNA and COI) and two nuclear genes (EF-1 $\alpha$  and H3) for 34 species of *Alterosa* and eight species of other philopotamid genera. Phylogenetic analyses were performed using Bayesian inference and corroborate the monophyly of *Alterosa* when the concatenated dataset was analysed. Considering the species groups proposed, the following results were obtained: (1) the *holzenthalii* group was corroborated as monophyletic and expanded with the inclusion of *A. capixaba*; (2) the *falcata* and *marinonii* groups were considered monophyletic with the exclusion of *A. jordaensis* and *A. capixaba*, respectively; (3) the *sanctipauli* group was recovered as polyphyletic, being rearranged with exclusion of five species and inclusion of *A. orgaosensis*; and (4) the *guapimirim* group was also recovered as polyphyletic and rearranged to include only two species, *A. guapimirim* and *A. itatiaiae*. Four new species groups were also proposed: *caparaonensis*, *paranaensis*, *schadrackorum*, and *truncata*. *A. ruschii* and *A. tripuiensis*, originally included in *sanctipauli* group and *guapimirim* group, respectively, and *A. catarinae* and *A. caymmii*, with uncertain position within species groups, were treated as *incertae sedis* within *Alterosa*.

### 37: Phylogeography of *Oxyethira tica* Harris & Holzenthal, 1992 (Hydroptilidae) in South America

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Phylogeography deals with the geographic arrangement of genetic lineages or among closely related species. This kind of study focusing on caddisfly species have been commonly conducted in the Palearctic Region, but there are no described phylogeographic pattern for any Neotropical one. *Oxyethira tica* is one of the few widely distributed Trichoptera species in the Neotropical Region, being recorded from Mexico to south of Brazil. To assess the population structure of the South American *Oxyethira tica*, we analyzed data from nuclear and mitochondrial (459 bp of cytochrome c oxidase I, COI) sequences. We found 37 haplotypes of COI (50 sequences) and 44 of CAD (49 sequences) from specimens collected in Alagoas, Bahia, Ceará, Minas Gerais, Pará, do Piauí, and Sergipe states, making up for 8 out of 11 major hydrographic regions in Brazil, and Trinidad and Tobago. Except for comparisons between Brazilian and Trinidad populations (significantly high *Fst* values), most other comparisons between Brazilian populations suggested high gene flow between them with significantly low *Fst* values. Median-joining haplotype networks of both molecular markers suggest no spatial structuring among Brazilian samples in relation to their hydrographic basins or major biomes. Results of the mitochondrial data show a widely distributed haplotype connected to several others differing only by a single mutation, possibly indicating recent population growth.

### 38: Molecular Phylogeography of the headwater-specific alpine caddisflies, *Pseudostenophylax* spp. (Limnephilidae)

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Aquatic insects inhabiting rivers, continuously adapt to the habitat's environment of each segment (*i.e.*, up-, middle- and downstream). Notably, species groups adapted to headwater environments are generally relatively small in their population size. That is, their various populations tend toward miniaturization, and so are usually scattered and isolated, having a patchy distribution. As a result, the potential for gene flow between populations is strictly limited, and so there is higher potential for genetic differentiation between populations, and the influence of random genetic drift is high. Moreover, the degree of relative genetic differentiation is often observed to closely reflect the events of the region's geological history. Genus *Pseudostenophylax*, a member of Limnephilidae, is distributed in East and Southeast Asia and North America. Larvae of *Pseudostenophylax* inhabit shallow side pools of high altitude mountain streams. *Pseudostenophylax* have been divided morphologically into 16 species-groups. In the Japanese Archipelago, two groups: the *ondakensis*- and *adlimitans*-group have been recorded. Of these, the *ondakensis*-group is composed of six species, and the *adlimitans*-group is composed of two species. In view of this, we conducted molecular analyses (mtDNA COI, and nuclear DNA ITS 2 regions) of these *Pseudostenophylax* caddisflies, mainly using the species inhabiting the Japanese Archipelago. As a result of this, it was shown that both of these groups are largely genetically differentiated. From the analysis of the COI region, the monophyly of each species was almost completely supported the results of our DNA analyses continued to support the previously defined morphological classification (Nozaki, 2013). Furthermore, in Hokkaido, a yet undescribed species largely different from the existing species was also observed. This meaning that in fact three caddisflies of the *ondakensis*-group inhabit Hokkaido. It is suggested that geological history of Hokkaido's formation during Pliocene period was deeply involved in their speciation. When we apply the generally used molecular clock model (3.54% per million years; Papadppoulou *et al.*, 2010), it is estimated that these three clades in Hokkaido (*P. kuharai*, *P. itoae*, *Pseudostenophylax*. sp.) differentiated about 4.54 MYA ( $\pm 2.26$ ; 95% HPD). During this period, the sea

level was just a little higher than present, and three distinct habitats are considered to have been isolated as independent islands.

**Keywords:** DNA, biogeography, phylogeny, East Asia, geological distance, genetic distance

**39: Phylogenetic Relationships in *Oligophlebodes***

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*Oligophlebodes* is a genus of caddisflies (Trichoptera: Uenoidae) endemic to the Western United States. Here we develop a phylogeny of the genus *Oligophlebodes* to answer questions about patterns of speciation across the range of species. Using DNA barcode (Cytochrome oxidase 1) data, we analyzed a sample of 44 individuals representing five species and one outgroup (Neophylax) ranging from Southern New Mexico northwest into British Columbia. Bayesian likelihood analysis under the HKY80 + I + Γ model gave the consensus topology (Neophylax, (sierra, ((sp1, sp2, (ardis, minutus)), ruthae)), sigma). Species identifications were supported by monophyly of species-level taxa. In the BOLD auto-generated TaxonID tree for *Oligophlebodes*, an unrooted neighbor-joining tree using the Kimura 2-parameter model, *O. sigma* was sister to the *O. ruthae* group, while in our tree the two taxa are polyphyletic. The novel topology produced supports exploration of a variety of methods of phylogenetic reconstruction of *Oligophlebodes* and other Trichopteran taxa using data from barcode databases as well as our own sequences.

**40: Phylogenetic analysis of *Leptonema* Guérin, 1843 (Trichoptera: Hydropsychidae: Macronematinæ)**

Gabriela A. Jardim, Daniela M. Takiya & Jorge L. Nessimian

*Leptonema* Guérin, 1843 is the most diverse genus in the subfamily Macronematinæ, with 136 species distributed in 15 species groups. Most species of the genus are distributed in the Neotropical Region, one of which reaches southwestern United States, and three species groups are recorded for sub-Saharan Africa and Madagascar. In order to conduct phylogenetic analyses, 125 morphological characters were coded from 115 species of *Leptonema* and seven outgroup representatives. Molecular data were obtained for 84 of these species, from five gene fragments: COI, 16S, 28S, CAD, and H3. The latter fragment was discarded in the combined analyses because it was incongruent with other partitions and decreased the resolution of the resulting trees. Parsimony analyses did not have resolution to recover the relationships between *Leptonema* and outgroups. Bayesian inference analyses with the combined molecular data and morphological and molecular data combined recovered the monophyly of *Leptonema* and its position as a sister group to the other genera of Macronematinæ. Of the 15 *Leptonema* species groups, seven were monophyletic in the Bayesian inference analysis with morphological and molecular data combined: *affine*, *cinctum*, *davisi*, *insulanum*, *normale*, *occidentale* and *simulans*. The *complexum*, *crassum* and *sparsum* groups were redefined to become monophyletic. A new species group, *lunatum* group, is proposed. *Leptonema anomalum* Flint, 2008 previously considered *incertae sedis*, was placed in the *stigmosum* group.

**41: A *Rhyacophila*-tree for Rhyacophilidae**

Julianne McLaughlin and Karl Kjer

We present a phylogeny of *Rhyacophila* from COI (barcode) sequences, and a 1000 nucleotide fragment of 28S rRNA (the D1-D3 region). In contrast to a recent similar paper on *Chimarra*, this phylogeny is poorly resolved, but does show the *verrula* group at the base of the entire family. The project was part of Rutgers “project SUPER”, which provides research and presentation opportunities for women in STEM disciplines at Rutgers. Methods, and learning objectives will be discussed, along with the results.

## Faunistics

### **45: Caddisflies collected by a Malaise trap at a springbrook of the Shimauchi-yusui in the Matsumoto Basin, central Japan: fauna and phenology**

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The Matsumoto Basin is flanked by 2,000–3,000 m-class mountains, which supply underground water to many springs in the lower fan zone. Most springs and spring-fed streams have been used for domestic water, and some of them are also used for cultivation of plants and trout. However, knowledge about fauna, especially invertebrates, of these spring-fed streams is scarce. The Shimauchi-yusui is one of spring-fed streams in this area. It is contributed by two springbrooks emerged from the left river terrace of the Narai River, and flows approximately 1 km to its confluence with the Narai River. The stream has been maintained by residents of this area, and kept clean water and rich aquatic flora. In this stream, we investigated adult caddisflies using a Malaise trap set at one of springbrooks. The study site (36°15'24.6"N, 137°56'42.3"E, 570 m a.s.l.) is about 300 m from the spring source with an average flow of about 35,000 t/day. The annual average temperature of water is 12.0°C (10.8–13.4).

Adult caddisflies were collected from the study site weekly from 11 April 2013 to 4 June 2014. A total of 11,877 specimens belonging to 39 species, 18 genera, 14 families were identified. The most abundant species collected in one year (the first 52 weeks) was *Agapetus sibiricus* (60%), followed by *Apatania aberrans* (12%) and *Micarsema spinosum* (5.4%). Larvae of these species live in stony bed and rich moss mats in the study site. Common 14 species (more than 50 individuals were collected in 60 weeks) had one or two major peaks in their flight periods. We report the caddisfly fauna of this springbrook and phenology of their flight period.

### **46: Review of the *Orthotrichia* (Hydroptilidae: Trichoptera) of Florida**

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The genus *Orthotrichia* was last reviewed in 1956 by Kingsolver and Ross, but drawings of the males were primarily restricted to ventral views and females of only one species was included. The six species comprising the genus in North America are all known from Florida and extensive collecting throughout the state has allowed us to associate the females with the males. With this paper, we provide new drawings of the males and females of the *Orthotrichia* in Florida.

### **47: Trichoptera research within project “EU Natura 2000 Integration Project –NIP”**

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Republic of Croatia is very rich in biodiversity which is a result of specific geographical position and climate, geomorphological and hydrogeographical conditions which create wide range of habitats. Unfortunately, a comprehensive inventory of Croatian biodiversity does not exist. A step towards achieving this goal is the project “EU Natura 2000 Integration Project –NIP“. NIP is under jurisdiction of [Ministry of Environment and Nature Protection](#) based on the Loan Agreement with the World Bank. One of the components of the project is a systematic inventory of biological diversity of those taxonomic groups which are considered as poorly investigated. One such group were caddisflies (Trichoptera) for which a team of all available national experts was formed in order to do field research and laboratory processing. The plan is to conduct Trichoptera inventory on selected 105 localities in Croatia in two years (2014-2015). In the first year 52 localities have been sampled three (3) times a year in the following periods: March-May, June-August and September-October. Trichoptera were collected during the day by hand and using an entomological net (sweep net) and during the night using UV light-traps with reflective canvas on a pyramidal construction. After the completion of the field survey and data analysis, the checklist of species recorded in Croatia for Trichoptera taxonomic group will be revised. So far field research and laboratory processing have been conducted at 77 localities. We recorded 124 species of Trichoptera. Very interesting finding is 2 potentially new species found at the spring of the Zrmanja River. According to our research, the most abundant species is *Rhyacophila fasciata* Hagen 1859, recorded at 27 localities. The number of known Trichoptera species in Croatia is 186. This is a very significant number for a relatively small country (56.594 km<sup>2</sup>). There are, however, still considerable gaps in our knowledge about taxonomy, distribution and ecology of many taxonomic groups, particularly of the invertebrate taxa. New species and subspecies are being discovered each year. A powerful tool for obtaining a more accurate number of species, but also discovering new, is DNA Barcoding. Therefore, among the first in Croatia, we started systematically with DNA Barcoding Trichoptera. Adult Trichoptera specimens collected within NIP project we DNA Barcoded using The Barcode of Life Data Systems (BOLD) methodology for barcoding.

#### **48: Trichoptera fauna of Bikin River Basin: from A.V. Martynov to the present days**

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Bikin River is one of the main right-bank tributaries of the Ussuri River and the last large river of the southern Russian Far East which was saved in natural condition up to now. Recently the Bikin River Valley is nominated as extension of the “Central Sikhote-Alin” World Heritage property (766) for including in the UNESCO Cultural and Natural World Heritage List. In the upper and middle part of the Bikin River Valley is planned to organize the National Park "Bikin".

The drainage basin of the river is located in the northern part of Primorye and cover 22.3 thousand km<sup>2</sup>. The total length of the River 560 km, the upper and middle parts of the basin are located in the mountains of the Sikhote-Alin between N 45° and 47° and E 136° and 138°. In comparison with other regions of Russia, the area has a unique landscape and biogeographical characteristics and a high density of rare and endangered species.

The freshwater invertebrates of the river was not well studied up to now, although some information on caddisflies was obtained by A.V. Martynov in 1927 when he collected 31 species and 15 of them was described as new (Martynov, 1934, 1935).

After 70 years some freshwater surveys was carried out in the area and results was published in the monograph "Ecosystems of Bikin River" where 33 species of caddisflies was recorded for the Bikin River basin (Zolotukhin et al., 1997). Later Arefina (2001, 2003) added 2 more species for Bikin River fauna. Our investigation was undertaken since 2000 and added to the caddis list 31 more species. Thus, the list of caddisflies collected in different parts of the Bikin River and its tributaries now includes 97 species from 49 genera and 19 families. The presented species list includes information on localities, dates of collection, taxonomical and ecological notes. In the paper biogeographical features of the Bikin River

trichopterofauna is discussed and compared with caddisfly fauna of other large river basins of the South Russian Far East.

**49: Distribution and new records of *Marilia* (Trichoptera: Odontoceridae) from Neotropics and description of a new species from Ecuador**

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*Marilia* Müller (Trichoptera: Odontoceridae) is a cosmopolitan caddisfly genus (except Antarctica Region) with 62 species described for world and 42 species occurring in the Neotropics. It can be recognized by the very large eyes of the males and diagnosed by the apices of veins R1 and R2 meeting at the edge of the forewing. In this study, one new species of *Marilia* from Ecuador is described and illustrated. Furthermore, distribution and new records of the genus from Neotropics is updated based on material from Museu de Zoologia, Universidade de São Paulo (São Paulo, Brazil), Laboratório de Entomologia Aquática – Universidade Federal da Bahia (Bahia, Brazil) and University of Minnesota Insect Collection (St. Paul, USA). *Marilia* sp. n. can be diagnosed by the presence of two acute lateral processes, separated with a deep, wide mesal invagination, covered dorsally by a single process rectangular, elongated, which slightly tapers towards the posterior portion, and by an U-shaped sclerite phallotremal. Tibial spurs: 2, 4, 4. New records of *Marilia* species from Neotropics are given from Argentina, Belize, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Guyana, Paraguay, Peru and Venezuela. Distribution records of poorly-known species are currently the most explored theme in the Neotropical literature. If properly evaluated, this kind of information can improve our knowledge about the spatial organization patterns of the species and the processes that induce to such biological arrangement over time.

**50: Faunistic and ecological characteristics of caddisflies (Insecta: Trichoptera) in the catchment area of the Cetina River in Croatia**

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The Cetina River is the longest Croatian River with 105 km of length. It is situated in the karstic region (calciferous substratum) which is geomorphologically important part of Croatia and, unfortunately, poorly investigated regarding aquatic fauna. Its source is located 50 kilometres from the coast, and it flows into the Adriatic Sea near the city of Omiš. Three largest tributaries of the Cetina River are: the Ruda River, the Grab River and the Rumin River.

The aim of the research was to define the composition, distribution and ecological features of caddisflies in the catchment area of the Cetina River. Samples of caddisflies were collected monthly from August 2004 till August 2005, using ultraviolet (UV) light trap at eleven (11) localities along the Cetina River and at two (2) localities at the Ruda River. Two (2) localities were studied at the Grab River and one (1) at the Rumin River monthly from April to September 2007. Physico-chemical parameters were also measured at all sampling stations.

A total of 72 species of caddisflies were found in the catchment area of the Cetina River. Results of the physico-chemical measurements and the composition and structure of caddisflies were processed with statistical methods used the program Statistica 7.1 and NMDS and cluster analysis. There were differences in the composition of caddisflies in the upper, middle and lower reaches. Some ecological features of caddisflies such as: seasonal dynamics, sex ratio, constant and dominant species, community diversity,

trophic structure of the study sites and the influence of the air temperature during the night of sampling were also investigated. The comparison of the similarities of caddisfly fauna with those from the Krka River, National Park “Plitvice Lakes”, the Kupa River and the Drava River has also been conducted.

**51: Conservation status of the Sequatchie caddisfly, *Glyphopsyche sequatchie* (Trichoptera: Limnephilidae) – a Candidate for Federal Listing in Tennessee**

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The Sequatchie caddisfly, *Glyphopsyche sequatchie* Etnier and Hix, is a rare limnephilid caddisfly whose known range is restricted to three sites in the Sequatchie River Valley, Tennessee. The species was discovered in 1994 from Owen Spring Branch, Marion County, approximately 25 air km west of Chattanooga. A second population was discovered four years later in Martin Spring, approximately 19 air km from the type locality. A single individual was discovered from a third site in the Sequatchie Valley in 2010. Due to its reduced range and perceived threats, the species was recognized by the U. S. Fish and Wildlife Service (Service) as a candidate for federal listing in 1999. In 2010 and 2011, we visited the known sites and surveyed 30 additional spring habitats in the Sequatchie River Valley and the Tennessee River Valley in Alabama in an attempt to determine the species' conservation status and locate additional populations. No additional populations were discovered. In 2014, quantitative surveys were completed at Owen Spring and Martin Spring. Preliminary population estimates suggest that the species is more abundant at both sites than first believed. Based on this new information, the Service is re-evaluating the species' listing status.

**52: Preliminary checklist to the caddisflies of Peru**

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The order Trichoptera Kirby, 1813 is a group of holometabolous insects with aquatic immature stages. They are ubiquitous and abundant in aquatic ecosystems, and are important in the flux of energy and matter in these environments. The Neotropical fauna is, in term of species numbers, only second to the Oriental region. Among the countries in the region, the Peruvian fauna is one of the most poorly known, mainly because there has been very few focused collecting efforts, and only in a handful of localities. To determine the number of species recorded from the country and the gaps in geographic coverage, a comprehensive literature search was performed. The records up until 1999 were gathered from the Catalog of the Neotropical Caddisflies (Insecta: Trichoptera) (Flint et al., 1999). For subsequent years, the Zoological Record database and the pertinent literature were used. A total of 340 species are recorded from the country, distributed in 13 families and 52 genera. The families with the highest number of species are Hydropsyidae with 110 (32.4%), Hydropsychidae with 83 (24.5%), and Philopotamidae with 35 (10.3%). Similarly, Hydropsyidae presents the highest number of genera with 17 (32.7%), followed by Leptoceridae with 10 (19.2%) and Hydropsychidae with 6 (11.5%). These numbers do not reflect the real diversity of the order in the country, especially when compared with other countries in the region with far less environmental heterogeneity and area. Furthermore, some genera and families occurring in the adjoining countries have been recorded from Peru (e.g., *Austrotinodes*, *Xiphocentronidae*), but no species have been described yet. Also, some relatively diverse genera only present a few records in country (e.g., *Marilia*). Finally, numerous species in collections are in the process of being described, meaning that the number of species in the country is probably much higher than presently known. A higher emphasis on the collection and association of the different life stages of Trichoptera is fundamental to improve our knowledge on this ecologically important group of insects.

**53: Trichoptera of Liaoning Province, People's Republic of China**

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The caddisfly fauna of Liaoning Province, in northeastern China, is one of the least known Trichoptera faunas in the People's Republic of China, with only 17 of the 1253 Chinese species reported to date from this Province (Yang et al. in press). A recent collection from Mt. Laopingding, Fencheng City, included 14 species, 10 of which are new records for the Province, representing 7 families not previously known from Liaoning. Included in the collection are 2 species that are new for China and 2 species that are new Palearctic China.

**54: Trichoptera of the biosphere reserve Montes Azules, Chiapas, Mexico**Rafael Barba-Alvarez<sup>1</sup>, Joaquín Bueno-Soria<sup>2</sup>, Carlos Ramírez-Martínez<sup>3</sup>

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During faunal and ecological studies developed at Biosphere Reserve Montes Azules in the Selva Lacandona Chiapas, México, the Trichoptera fauna in the rivers Lacantún, Lacaná and Arroyo José (135 – 154 m above sea level) was collected in nine visits, from August 2012 to April 2015. This Biosphere Reserve is located at 16° 05' to 16°57' N; 90°45' to 91°30' W and covers 331,200 hectares, with altitudinal variations ranging from 120 meters at the River Lacantún and a maximum altitude of 1,500 m in the northern region of the Reserve at the Plateau Ocotal. In the studied area there are several climatic regimes, from the hot - humid temperate to humid – warm, rainfall varies from 1,500 to 3,500 mm per year; although most of the region receives between 2,500 and 3,500 mm annually. The water in the sampled rivers has an average annual temperature from 24-26 °C and pH 6 to 7. For the state of Chiapas 168 species were registered until 2010, after this study 11 new records of Caddisflies were added, therefore now 179 species are confirmed for Chiapas. The new records are, *Synoestropsis punctipennis*, *Plectropsyche hoogstraali* (Hydropsychidae); *Protoptila cristula* (Glossosomatidae); *Oxyethira janella*, *Mayatrichia ayama*, *Hydropsila furtiva*, *Ochrotrichia tarsalis* (Hydroptilidae); *Chimarra (C.) colmillo* (Philopotamidae); *Cernotina zanclana*, *Polyplectropus kylistros* (Polycentropodidae); and *Marilia crea* (Odontoceridae). From these species, three are new records for Mexico, *Chimarra (C.) colmillo* (Philopotamidae), *Polyplectropus kylistros* (Polycentropodidae), and *Marilia crea* (Odontoceridae).

**55: The first check list of caddisflies (Insecta, Trichoptera) of the Republic of Macedonia**Mladen Kučinić<sup>1</sup>, Vladimir Krpač<sup>2</sup>, Iva Mihoci<sup>3</sup>, Halil Ibrahimović<sup>4</sup>, Wolfram Graf<sup>5</sup>, Ana Previšić<sup>1</sup>, Simon Vitecek<sup>6</sup>, Johann Waringer<sup>6</sup>

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In South-Eastern Europe the Balkan Peninsula represents one of the most interesting centres of biodiversity for different animal groups, including Trichoptera. The Republic of Macedonia is located in the Western Balkans, and harbours due to its geology highly diverse hydrological biotopes (rivers, streams, springs, lakes), particularly in mountain areas. In the Republic of Macedonia there are 1,100 large sources of water. The rivers flow into three different basins: the Aegean, the Adriatic and the Black Sea.

This work presents the first check list of Trichoptera of Macedonia that has been made based on the faunal data from literature, data from caddisflies collection of the Macedonian Museum of Natural History in Skopje and data collected throughout seven years of our own research. We primarily investigated the north-western and south-western parts of Macedonia, with particular focus on the Mavrovo and Pelister National parks. In this check list we included only data according of determinations of adults.

Apart from presenting the check list, we also present some interesting endemic and relict species from Macedonian caddisflies fauna (e.g., *Rhyacophila lutika*, *Agapetus rectigonopoda*, *Wormaldia kimminsi*, *Phryganea ochrida*, *Drusus plicatus*, *D. macedonicus*, *D. vernonensis*, *Drusus* sp.n., *Chaetopteroides tunik*, *Potamophylax lemezes*, *Rhadiocleptus alpestris macedonicus*, *Oecismus mucidus*) and compared diversity of caddisfly from Macedonia with other surroundings countries.

#### **56: Investigation of caddisflies (Insecta, Trichoptera) fauna in the National Park Mavrovo (Republic of Macedonia)**

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The National park Mavrovo is the largest National Park in the Republic of Macedonia. The protected area, that included 117km<sup>2</sup>, was established in 1949, and since then the park was expended to 731 km<sup>2</sup>. The National park is situated in north-west part of the Republic of Macedonia in mountain area (altitude 1200 – 2800 metres) and it includes 3 mountain systems, represented with 52 hilltops and peaks with higher of over 2000 metres. The mountain system Korab have the peak Golem Korab with 2746 metres of elevation which is the highest peak in the Macedonia. The river Radika flows through the middle of Mavrovo Nationa Park with lot of small stream and springs. Except rivers and mountain streams and springs in National park of Mavrovo is situated several lakes. Some of them are glacial. The biggest lake in National park is the Mavrovo Lake. This lake is artificial, situated in 1220 meters of elevation.

Our systematic investigation of caddisflies in National park Mavrovo has started in 2008 and continues to this day. We have collected material from 15 different biotope localities: springs, streams, rivers, lakes. The collected material is deposited in caddisflies collection on the Croatian Natural History Museum in Zagreb and in the Macedonian Museum of Natural History in Skopje.

This work presents the first checklist of caddisflies of the National Park Mavrovo. The most interesting species which we collected during our investigation belong to the family Limnephilidae, genus *Drusus*, in which we found a new species from the Korab mountain. This micro-endemic species belong to new groups of filtering carnivorous caddisflies. From genus *Drusus* in the National Park Mavrovo we found six species: *Drusus* sp. n., *D. biguttatus*, *D. botosaneanui*, *D. discolor*, *D. plicatus* and *D. tenellus*.

Furthermore, new species from the genus *Potamophylax*, *P. lemezes* was described. This species was found only one locality (*locus typicus*), in the spring of the Galičnik River. Also, a new stoneflies speceies, *Siphonoperla korab* was found and described from the Korab Mt.

#### **57: Faunistic features of caddisflies (Insecta: Trichoptera) in different types of habitats in the catchment area of the Dobra River**

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The catchment area of the Dobra River, including the whole course of the Dobra River (8 localities) and its tributaries: the Kamačnik (3 localities), the Zagorska Mrežnica spring (1 locality), the Sabljaci reservoir (1 locality) was the site of a study with the aim of determining the faunistic and ecological features of caddisflies (Trichoptera). The samples of adult caddisflies (imago) were collected monthly in a period of 13 months (from early November 2009 until the end of November 2010) by ultraviolet (UV) light trap and the entomological nets. Physico-chemical parameters of water and air were also measured at all sampling stations. The research included several segments of caddisfly fauna: the composition at each locality and each habitat type, new records in the Croatian fauna, the distribution of all recorded species, seasonal dynamics, the sex ratio for each type at each site including data on the dominant and constant species. The Shannon-Weaver and Simpson diversity indices and the Sørensen similarity index of fauna have also been calculated. Results of the physico-chemical measurements and the composition and structure of caddisflies were processed with statistical methods used the program Statistica 9, NMDS and cluster analysis. A total of 23.752 individuals belonging to 81 species were collected and 17 of these species and 4 genera were new records for Croatian caddisfly fauna. The results of the study should become a baseline for similar faunistic-ecological and biogeographical studies of caddisflies, as well as for studying some other features of this segment of the Croatian fauna.

Especially interesting species in this study were: *Rhyacophila palmeni*, *Agapetus laniger*, *Hydroptila lotensis*, *Hydroptila tineoides*, *Ithytrichia lamellaris*, *Orthotrichia angustella*, *Micrasema minimum*, *Micrasema sericeum*, *Drusus chrysotus*, *Drusus croaticus*, *Ceraclea riparia*, *Setodes punctatus*, *Setodes bulgaricus* and *Oecetis notata*.

**Keywords:** caddisflies (Trichoptera), biodiversity, distribution, Dobra River

#### **58: A Preliminary Specimen-Level Database of the Caddisflies of California**

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Large efforts have catalogued species of California Trichoptera: the Aquatic Insects of California in 1956, Don Burdick's online checklist in 2010, and Ball et al.'s survey of California Mediterranean Climate Freshwater Biodiversity in 2012, however none include detailed specimen-level records. In this project, we consolidate 5,000 digital records from online digital sources (GBIF, includes EMEC, UASM, INHS), records from CAS and online checklists (Don Burdick, Bill Shephard) to create a specimen-level database and an updated checklist of the Caddisflies of California. We also include biomonitoring records from the California Digital Exchange Network (CEDEN) to expand the larval genus-level occurrence information by 14,500 recent records. The database contains almost 20,000 records cataloging 419 species in 19 families. Here we present a preliminary MS Access database with basic metrics of database content and species distributions. Next steps include reconciling taxonomic names, georeferencing records, adding verbatim information for CAS, QA/QC for species names and records, and create a format for sharing the database online.

#### **59: Discovery of *Eubasilissa signata* Wiggins,1998 (Trichoptera, Phryganeidae) from Taiwan.**

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The phryganeid tricopteran, *Eubasilissa signata* Wiggins, 1998, was originally described based on a single female specimen deposited in the Zoologisches Museum, Humboldt-Universität zu Berlin. According to the original description, only "Korea" was put on the label of the type material, and details of the specimen data including exact locality, date and collector have been unknown. Recent survey in Korea by the senior author and the Korean colleague failed to find any additional specimens of this species.

In the course of examining the specimens of genus Eubasilissa in Japanese museums, the senior author found a female specimen of *E. signata* from Taiwan at the Kitakyushu Museum of Natural History and Human History. Moreover, the second author collected male and female specimens of *E. signata* from central Taiwan. In the presentation, we show the morphology of male *E. signata* in the first time, and we discuss the relationships between *E. signata* and congeners.

**60: Observations on the larva of the genus *Setodes* Rambur, 1842 (Trichoptera: Lepidoptera: Leptoceridae) from Ile-Ife, Southwestern**

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The mature larva of an unnamed species of the caddisfly genus *Setodes* (Trichoptera: Leptoceridae) from Ile-Ife, southwestern Nigeria, is observed and some important features described. The larva can be characterized by the pattern of arrangement of the 12 muscle scars on the frontoclypeal apotome, slightly curved larval case made of fine and coarse sand grains, four setae on both sides of the labrum and 13 setae located on the sclerites on both sides of the head. Larvae were collected from the sandy bed of the littoral zone of a small tropical reservoir. Additional information is needed on diagnostic features to complement the existing taxonomic data for the separation of this species from known and described species in the genus in Africa.

**61: Testing barcode identification specificity from under-sampled regions**

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The barcode initiative is well advanced in Trichoptera, with over 4,500 species databased. The records are clustered; North America, Europe, Thailand, Japan, Australia, and New Zealand are well-represented, while records from Africa or India remain sparse. We recently received Trichoptera material from Kathy Hill, who had been collecting cicadas in the Philippeans and Vietnam. We decided to test the efficiency of the barcode database in identifying this material, and comparing this efficiency to aquatic insect samples from New Jersey, which is well sampled for Trichoptera, but not other groups.

**62: Concepts learned in teaching barcoding**

Jade Shevchenko, Julianne McLaughlin, Marzia Lisa, Stan Piotrowski, and Karl Kjer

Kjer has been teaching DNA barcoding to undergraduate students at Rutgers through a variety of programs, including the Byrne seminars, women in science initiatives, the Aresty research program, and independent honors programs. It is important for students to recognize that DNA comes from organisms in the environment, not plastic tubes. They also learn basic concepts in collection, vouchering, lab chemistry, PCR, gel electrophoresis, DNA sequencing, DNA editing, and databasing.

**63: Updated checklist of the Michigan (USA) caddisflies**

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Based on examination of >160,000 adult specimens, 298 caddisfly species are reported from Michigan, representing 22 families and 77 genera. Of these, 51 species are reported from the state for the first time and 183 are new since the previous Michigan checklist (Leonard and Leonard 1949). Specimens were collected from >400 collecting localities throughout the state during 1930–2014, including intensive ultraviolet backlighting during 2010–2011. The 10 most abundant species accounted for ~50% of total specimen abundance; whereas, 30% of the fauna was known from <10 specimens, and 11% was known from a single specimen. Considering that >20% of the total fauna, and 35% of the hydroptilid fauna, has been discovered since 2010, it is likely that additional species remain undiscovered.

#### **64: The Trichoptera (Insecta) of the lower Kunene River in Namibia and Angola**

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The invertebrate fauna of the Kunene River was investigated by De Moor et al. (2000). Together with previous results a total of 251 species were recorded covering all aquatic insect orders. Caddisflies (Trichoptera) belong to the more species-rich groups with a total of 30 taxa. Of these, 12 were regarded as undescribed species. About five species were found as immatures, and were identified at the generic level only. Together with previously recorded species a total of 41 species are presently known from the Kunene River.

The author has been visiting the Kunene River three times in the past (2000, 2008 and 2012). Caddisflies and aquatic Lepidoptera were collected on several localities on the Namibian side downstream the Ruacana power plant. Field work concentrated on adults, which were collected by light traps. All species names published from the Kunene up to now and the results of recent fieldwork are summarised. A total of 48 species are listed. This number is, however, an artefact due to overlapping identifications of larvae, pupae and adults, which cannot be associated clearly. In addition, a number of published names seem to be synonyms, which reduce the total number further down. The author has collected 28 species including four undescribed ones. Descriptions of the new species are provided.

The Kunene and the Okavango-Zambezi systems share about 70 species of fish, confirming ancient links between these systems mediated by the Etosha Pan. The Pan was a lake fed by the Kunene River before the drainage system changed and the Kunene diverted westwards to the Atlantic about 35 000 years ago (Barnard 1998). The Trichoptera share the majority of species with the Okavango River system. The species richness of the Kunene is, however, considerably reduced. The reasons are discussed in terms of ecological conditions of desert streams and the influence of the power plant at Ruacana for the downstream fauna.